

COMMUNITY-SCALE DESIGN VARIABLES:

Application to the Proposed Development of
Nabeul, Tunisia

by

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Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Architecture

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July, 1967

Signature of Author

A handwritten signature in dark ink, appearing to read "R. K. Lewis". Below the signature is a horizontal line with several small, illegible handwritten marks or initials underneath it.

Department of Architecture

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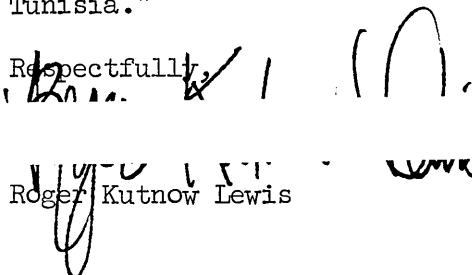
June 19, 1967

Dean Lawrence B. Anderson
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Dear Dean Anderson:

In partial fulfillment of the requirements for the degree of Master of Architecture, I hereby submit this thesis entitled "COMMUNITY-SCALE DESIGN VARIABLES: Application to the Proposed Development of Nabeul, Tunisia."

Respectfully,


Roger Kutnow Lewis

ACKNOWLEDGEMENTS

This paper reflects the ideas of many people as well as my own, and I therefore am grateful to all those who provided me with their insights and criticism. I want to thank Professor Horacio Caminos, who allowed me to depart considerably from the main theme of his studio in undertaking this study, thereby promoting what should be productive "cross-pollination" between fields of interest. Professor Caminos gave freely of his time to produce the documented design history in Phase Two, for which I am very appreciative. Also, much guidance and encouragement came from Arlo Braun and John Borrego, research associates working with Professor Caminos.

I wish to thank the M.I.T. Department of Architecture for the opportunity to work with the project group doing research in systems analysis in building design under the sponsorship of the National Science Foundation. This involvement has been instrumental in supporting this study. It is my hope that the interaction between thesis work under Professor Caminos and the research for the NSF project will have been fruitful to both.

Nancy Jones deserves special thanks since her patience and fortitude yielded this handsomely typed document.

Finally, credit should go to the Peace Corps and the Republic of Tunisia for having given me the opportunity to spend two years working and living in Nabeul.

I dedicate this thesis to my new wife.

ABSTRACT

This thesis investigates the multiplicity of community-scale design variables -- factors which in some way shape or influence the form of physical environment -- and records and classifies them in a checklist which might be useful as a guide and reminder to an architect facing an urban design problem.

The investigation took place in three phases. The first phase consisted of the identification and sorting of variables, accompanied by research into information theory related to design, in order to "theoretically" generate the checklist of variables.

The second phase consisted of the recording and analyzing of the history of a design already carried out and in execution, the campus plan for the University of Los Andes in Merida, Venezuela, designed by Professor H. Caminos. This permitted testing and modification of the checklist.

The third phase of the study focused on an actual, studio design problem, intended to allow use and application of the checklist. This project involved the development plan for the town of Nabeul, Tunisia, a concentrated community of about 27,000 inhabitants on the North African coast. By applying what was derived theoretically to a real-world problem, the concreteness, completeness, and utility of the set of design variables was further tested.

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INTRODUCTION

Architects and planners realize that the basic process of design ranges in scale from the smallest component of a building to entire metropolitan regions. The central design activity which is aimed at producing some kind of environmental system occurs throughout this range of scales. Thus, there exists a continuum which represents the environmental design problem as it progresses from building scale to city scale, or from architecture to planning.

It seems that there is little justification for differentiating design scales so completely when there is considerable interaction between all components of physical environment. For example, an architect who designs a building is usually very much at home when dealing with massing, lighting, heating and ventilating systems, or structures. He is usually conversant with related technical, social, and economic disciplines. However, architects are much less at home when they are designing at the community or urban scale.

There are several reasons for the tapering off of competence as the scale of the problem increases. Clearly, the most important is associated with the degree of complexity that enters into the larger scale problems. The discipline of community scale design is, in fact, a relatively new field

in which most architects lack experience, guidelines and knowledge.

There is a very large gap between the architect's knowledge and the city planner's knowledge. This gap needs to be bridged. Both architects and planners must recognize the complexity of environmental design and the need to mix disciplines. Perhaps the first task in bridging the gap is to make designers aware of the multitude of variables that they must consider in community scale problems.

The main effort of this thesis (Phase One) consists of the identification and listing of variables which influence in some way the design of physical environment and which include the components of environment as well. Listing variables implies looking at the design process, since the eventual use of such a list would be as an aid to design. In Phase Two, the history of Professor Horacio Caminos' design for the new campus of the University of Los Andes in Venezuela was studied to test and verify the variable checklist generated in Phase One. The revised list was then utilized in Phase Three to aid in formulating a development plan for the town of Nabeul, Tunisia. The application phases of the thesis were very much dictated by listing issues. The derived list of variables would be realistically tested by applying it to specific problems.

As the work progressed, the list of variables grew and changed throughout all phases.

Although it is only one step taken in one direction, the identification of variables might be a fundamental approach to problem solving. In fact, this study is more an indication of that approach than it is a definitive tool. At present, many of the methods used to attack community scale design problems are unrigorous and highly subjective. While recognizing the importance of subjective judgment and insight in any design problem, there is great room for systematic problem-solving approaches. Indeed, such methods can free the designer to spend much more of his time making subjective judgments.

PHASE ONE

The Identification of Community Scale Design Variables

At present we describe our environment by categorizing its aspects, both physical and non-physical. Social scientists talk about sociological, cultural, psychological, and even philosophical aspects. The physical planner focuses on functional aspects: transportation and communication, housing and education, public services, industry and commerce, administration and welfare. There are political and legal aspects which pertain to physical environment. All of these aspects represent either components of or forces upon the community. They interact spatially and, perhaps as significantly, they interact temporally.

What is meant by the terms "community-scale" and "design variable?" As will be seen later in the development of this study, the problem of definition is ever present. "Community-scale" refers very simply to design problems which focus upon urban, neighborhood, village, or city scale environments. More concisely, "community-scale" denotes a macro-scale which subsumes the building scale. To design a community usually implies designing some kind of urban system of which one set of components is buildings.

There is considerably more confusion generated by the

term "design variable." In the first place, the term "variable" is used here in a completely non-mathematical and non-quantitative way. "Design variables," in the context of this thesis, mean considerations or issues or factors, fixed or flexible, which the designer takes into account as he seeks to resolve or analyze a problem. It would have been perhaps as easy to use the word "parameter" or "factor." The point is that such words are not intended to be as precise as most scientific disciplines demand.

Typical community-scale design variables are population norms, infrastructure costs, transportation and communication systems, dwelling facilities, or physical site conditions. Such a compilation of variables would include designer-related issues, considerations of temporal and perceptual factors, goals, resources, and politics.

The ultimate objective of identifying variables is to aid in design decision-making. The search is for those which will shape the design process and the design product, without in any way stating how to make decisions or what the design product should look like. As an illustration of some lists which have been generated to aid planning, the Construction Specification Institute's list and a

list of investment procedures are partially reproduced below (Illustrations #1 & 2).

The Uniform System for Construction Specification is a classification of materials and components of which a building is constructed. In other words, it is a description by category of the product. The list of investment procedures represents a method of analysis leading to developing a product. The comparison between the two is a comparison of ends and means.

At this point, to identify and list variables will require no more than a classification effort. No attempt will be made to define explicitly the interactions between variables. It is very important to recognize this limitation, since the process of relating variables and making design decisions is the real task of the designer, whereas a set of variables does not necessarily describe process.

Despite the fact that no explicit design methodology is being proposed, there are relationships between design process and design variables which should be understood. The process of design occurs over time and is influenced by both the problem context and the designer's judgment. Put simply, the design process consists of an individual solving a problem by sequentially selecting variables

5 METALS

0500. ALTERNATES
0501. - 0509. unassigned
0510. STRUCTURAL METAL
0511. - 0519. unassigned
0520. OPEN-WEB JOISTS
0521. - 0529. unassigned
0530. METAL DECKING
0531. - 0539. unassigned
0540. LIGHTGAGE FRAMING
0541. - 0549. unassigned
0550. MISCELLANEOUS METAL
0551. Metal Stairs
0552. Floor Gratings
0553. Construction Castings
0554. - 0569. unassigned
0570. ORNAMENTAL METAL
0571. - 0579. unassigned
0580. SPECIAL FORMED METAL
0581. - 0599. unassigned

6 CARPENTRY

0600. ALTERNATES
0601. - 0609. unassigned
0610. ROUGH CARPENTRY
0611. Framing & Sheathing
0612. Heavy Timber Work
0613. - 0619. unassigned
0620. FINISH CARPENTRY
0621. Wood Trim
0622. Millwork
0623. Wood Siding
0624. - 0629. unassigned
0630. GLUE-LAMINATED WOOD
0631. - 0639. unassigned
0640. CUSTOM WOODWORK
0641. Custom Cabinetwork
0642. Custom Panelwork
0643. - 0699. unassigned

7 MOISTURE PROTECTION

0700. ALTERNATES
0701. - 0709. unassigned
0710. WATERPROOFING
0711. Membrane Waterproofing
0712. Hydrolithic Waterproofing
0713. Liquid Waterproofing
0714. Metallic Oxide Waterproofing
0715. DAMPPROOFING
0716. Bituminous Dampproofing
0717. Silicone Dampproofing
0718. Cementitious Dampproofing
0719. Preformed Vapor Barrier
0720. BUILDING INSULATION
0721. - 0729. unassigned
0730. SHINGLES & ROOFING TILES
0731. Asphalt Shingles
0732. Asbestos-Cement Shingles
0733. Wood Shingles
0734. Slate Shingles
0735. Clay Roofing Tiles
0736. Concrete Roofing Tiles
0737. Porcelain Enamel Shingles
0738. Metal Shingles
0739. unassigned
0740. PREFORMED ROOFING & SIDING
0741. Preformed Metal Roofing
0742. Preformed Metal Siding
0743. Asbestos-Cement Panels
0744. Preformed Plastic Panels
0745. Custom Panel Roofing
0746. - 0749. unassigned
0750. MEMBRANE ROOFING
0751. Builtup Bituminous Roofing
0752. Prepared Roll Roofing
0753. Elastic Sheet Roofing
0754. Elastic Liquid Roofing
0755. - 0759. unassigned
0760. SHEET METAL WORK
0761. Sheet Metal Roofing
0762. Metal Roof Flashing & Trim
0763. Gutters & Downspouts
0764. Grilles & Louvers
0765. Decorative Sheet Metal Work
0766. - 0769. unassigned
0770. WALL FLASHING
0771. - 0779. unassigned
0780. ROOF ACCESSORIES
0781. Plastic Skylights
0782. Metal-Framed Skylights
0783. Roof Hatches
0784. Gravity Ventilators
0785. - 0789. unassigned
0790. CALKING & SEALANTS
0791. - 0799. unassigned

5 METALS

STRUCTURAL METAL

OPEN-WEB JOISTS

METAL DECKING

LIGHTGAGE FRAMING

MISCELLANEOUS METAL

Metal Stairs

Floor Gratings

Construction Castings

ORNAMENTAL METAL

SPECIAL FORMED METAL

SPECIFICATION OUTLINE

Broadscope Section encompasses primary structural elements of steel or other metal, including fabrication & erection requirements. See also 2 PILING and 2 SHORTING & BRACING.

Broadscope Section encompasses short-span & long-span open-web joists, bridging, anchors, & accessories.

Broadscope Section encompasses ribbed, fluted, & cellular metal units for floor or roof decks. Metal roofing of the sort that does not require application of a separate weather surface should be specified in 7 PREFORMED ROOFING & SIDING or 7 SHEET METAL WORK.

Broadscope Section encompasses metal stud & joist systems, metal tubing, and similar material, including fasteners & accessories.

Broadscope Section encompasses the various metal items customarily manufactured to more or less standard details in sizes conforming to specific project requirements. It may be desirable in some cases to specify certain miscellaneous metal items under one or more of the Narrowscope Sections described below under Metal Stairs, Floor Gratings, & Construction Castings or in other Sections established for the particular project. These may be used in place of or in addition to the MISCELLANEOUS METAL Section. Grilles & louvers of sheet metal may sometimes be specified in this Section, but are normally best specified in 7 SHEET METAL WORK. See also 5 ORNAMENTAL METAL & 5 SPECIAL FORMED METAL, as well as various Sections of Division 10.

Narrowscope Section encompasses metal stairs, stair landings, railings, ladders, & fire escapes. For preassembled metal stair forms, see CONCRETE FORMWORK.

Narrowscope Section encompasses metal gratings installed as heavy-duty floor surfacing, balconies, catwalks, stair treads, areaway covers, sidewalk vault covers, and in similar locations. Concrete-filled floor armoring grids may sometimes be specified in this Section, but are normally best specified in 9 SPECIAL FLOORING.

Narrowscope Section encompasses construction castings of various sorts, including downspout boots, corner guards, foundation vents, & similar cast metal items of a utilitarian nature. See also 2 SITE DRAINAGE for downspout connections and various drainage castings. Manhole covers & frames not related to the drainage system are normally best specified here.

Broadscope Section encompasses nonferrous metalwork of a custom & more or less highly finished nature. Decorative grilles & louvers should be specified here if wrought, cast, or die-cast. Decorative sheet metal grilles & louvers may sometimes be specified in this Section, but are normally best specified in 7 SHEET METAL WORK. See also various Sections of Division 10, 12 ARTWORK, & 12 ECCLESIASTICAL EQUIPMENT.

Broadscope Section encompasses ferrous metalwork of a semi-custom or custom nature, particularly that requiring the use of die-forming or progressive-roll-forming processes.

"UNIFORM SYSTEM FOR CONSTRUCTION SPECIFICATIONS, DATA FILING & COST ACCOUNTING", 1966, PP. 1.12, 3.4

1. "UNIFORM SYSTEM" LIST OF BUILDING COMPONENTS & MATERIALS.

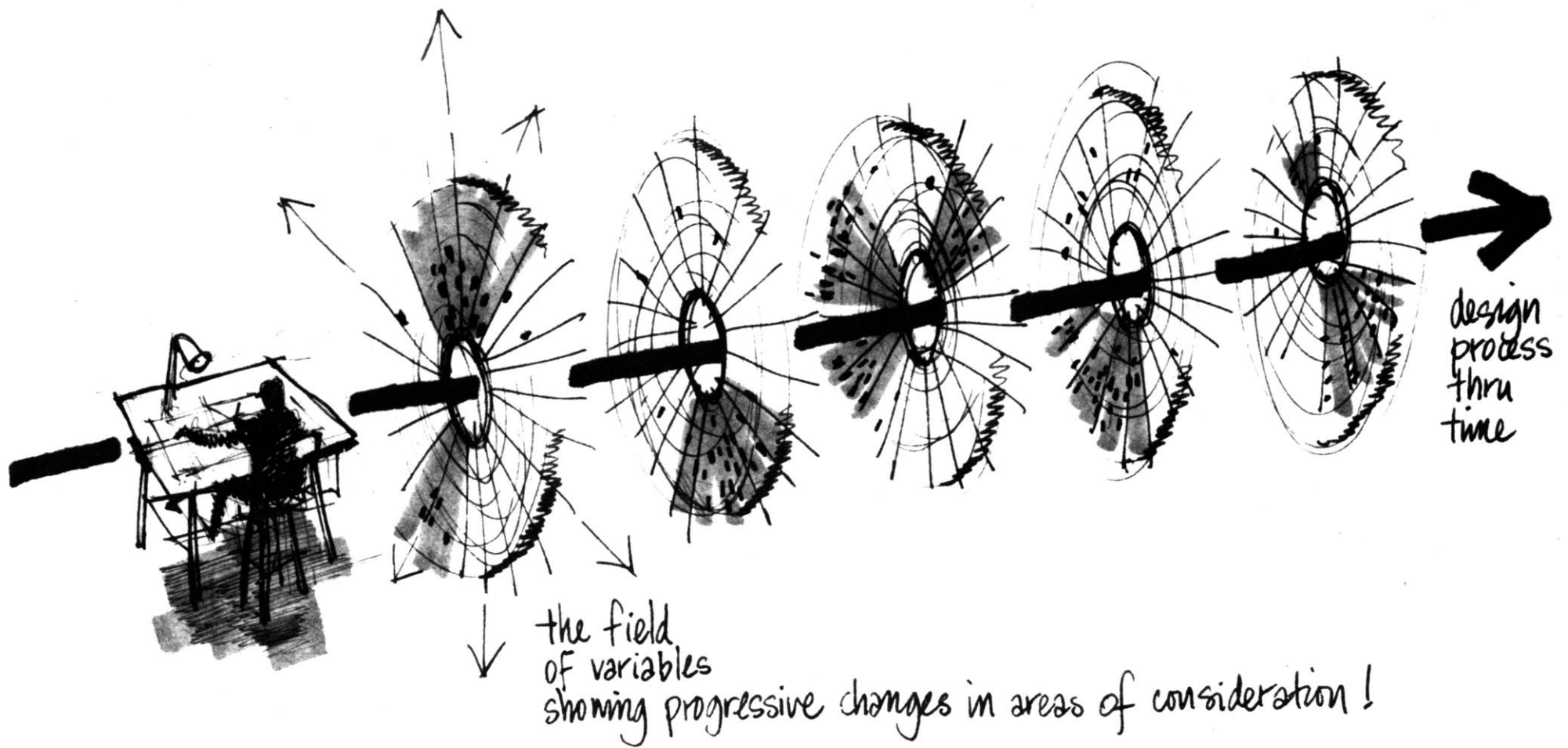
- I. Background knowledge, preconditions to initiation
 - A. The state of the housing market, i.e., price classes and sales rates
 - B. The state of the mortgage market, i.e., the availability and cost of funds
 - C. Construction costs
 - D. General information on land prices and availability
 - E. General information on the state of regulation, taxes, and community services in the market area
- II. Exploratory studies or analyses
 - A. Comparison of the cost and suitability of alternative sites
 - B. Pricing of the most favorable sites
 - C. Preliminary check with the lender on the suitability of the site selected
 - D. Preliminary check on zoning of the site selected
 - E. Preliminary check on subdivision code affecting the site selected
 - F. Preliminary check on the building code affecting the site selected
 - G. Preliminary inquiry with site engineer or landscape architect regarding cost of site development
 - H. Preliminary check with architect or general or subcontractor on modifications of building plan
 - I. Check with potential general subcontractors on current costs and prices and on costs of potential modifications of building plans
 - J. Preliminary check with sources of front money or equity capital
- III. Tentative decision to go ahead
 - A. Optioning of site
 - B. Retention of landscape architect for site planning
 - C. Review and first approval by sponsor of subdivision plan
 - D. Submission of subdivision plan to the city
 - E. Submission of streets plan to city engineer
 - F. Check with water company regarding service connections
 - G. Check with sewer department regarding outfall requirements
 - H. Check with local utility regarding power availability at the site
 - I. Submission of subdivision plan to FHA
 - J. Retention of architect for preparation of house plans
 - K. Review and first approval of house plans by sponsor
 - L. Submission of preliminary plans to mortgage lender
 - M. Submission of FHA insurance application to mortgage lender
 - N. Submission of detailed plans to potential syndicate or partnership members
 - O. Drafting of syndicate or partnership agreement
- IV. Primary decision to invest
 - A. to O. Repeat for final agreements

WILLIAM L. C. WHEATON, "PUBLIC AND PRIVATE AGENTS OF CHANGE IN URBAN EXPANSION" IN EXPLORATIONS INTO URBAN STRUCTURE (MELVIN M. WEBBER, ED.), PHILADELPHIA, THE UNIVERSITY OF PENNSYLVANIA PRESS, 1964, PP. 172-173.

2. INVESTMENT PROCEDURE LIST

for simultaneous consideration, variables which, at a particular point in time, are judged to be critical. The design process may be thought of as a methodology determined by the designer which operates through time upon the variables. The designer begins by choosing certain aspects of the problem to analyze or solve and proceeds further to deal with other aspects until he arrives at a point where all of the constraints and goals have been satisfied (Illustration #3). What makes each designer's end product unique is the sequencing of variable consideration, the choice of variables, and most significantly, the subjective evaluations, sensitivity, and judgments of the designer.

Reflecting further on design, there appears to be a complex process of integrating all scales of variables at a rapid pace throughout the course of the design. This means that, at any given instant, the designer is operating with many explicit goals in mind, backed up by an even greater number of implicit goals. What is a means one day can become a goal the next. For the planner laying out a road, the road, at one stage in the design, is a means to achieving certain overall transportation goals. At another stage of the design, the road itself



3. THE RELATION OF DESIGN PROCESS TO VARIABLES.

becomes a goal and a method of construction becomes the means.

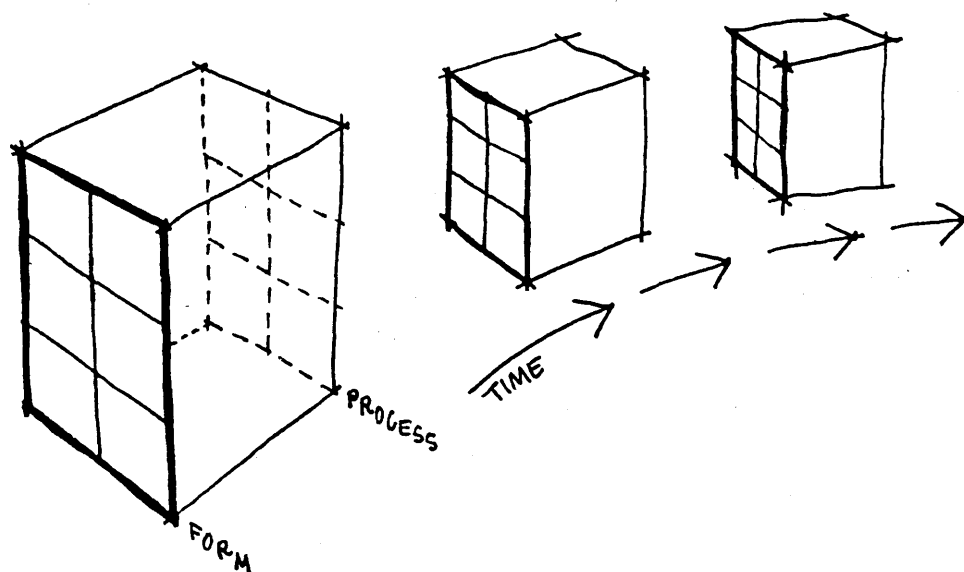
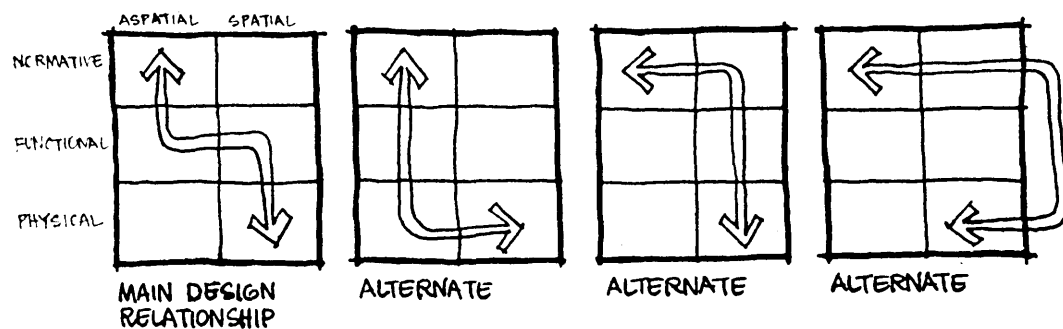
Clearly, there is a continuum of goals and means as well as of variables. Donald Foley in Explorations into Urban Structure develops a broad description of design and design issues which attempts to show some of the complexities of this process (Illustration #4). His graphic format indicates one approach to relating design and design variables at the urban scale. While his description is broad in scope, it is still not yet a useable tool or checklist.

By way of further illustration, it is worthwhile to note some other efforts made to describe design process in very general, theoretical terms. In an article entitled "Design Method in Architecture," Geoffrey H. Broadbent analyzes the design process and suggests that the "full, creative design process in architecture" might consist of the following:

- | | |
|---------------------|---|
| 1. <u>Briefing</u> | Programming, data collection, and so on. |
| 2. <u>Analysis</u> | Formulation of performance specifications. Identification of constraints. |
| 3. <u>Synthesis</u> | (i) Ideas generation and evaluation. |
| 4. <u>Synthesis</u> | (ii) Development of complete building. |
| 5. <u>Appraisal</u> | Check against performance specifications and constraint (recycle as necessary). |

	ASPATIAL*	SPATIAL*
NORMATIVE OR CULTURAL ASPECTS	SOCIAL VALUES CULTURE PATTERNS NORMS INSTITUTIONAL SETTING TECHNOLOGY	SPATIAL DISTR. OF CULTURE NORMS & PATTERNS; VALUES & NORMS CONCERNING QUALITY & DETERMINATION OF SPATIAL PATTERNS OF ACTIVITIES, POPULATION & THE PHYSICAL ENVIRONMENT.
FUNCTIONAL ORGANIZATIONAL ASPECTS	DIVISION AND ALLOCATION OF FUNCTIONS; FUNCTIONAL INTERDEPENDENCE; ACTIVITY SYSTEMS & SUB-SYSTEMS, INCL. PERSONS & ESTABLISHMENTS IN THEIR FUNCTIONAL ROLE SENSE.	SPATIAL DISTRIBUTION OF FUNCTIONS & ACTIVITIES; LINKAGES (FUNCTIONAL RELATIONS SPATIALLY CONCEIVED); SPATIAL PATTERN OF ESTABLISHMENTS, BY FUNCTIONAL TYPE.
PHYSICAL ASPECTS	PHYSICAL OBJECTS; THE GEOPHYSICAL ENVIRONMENT, MAN DEVELOPED PHYSICAL IMPROVEMENTS, PEOPLE AS PHYSICAL BODIES; QUALITIES OF THESE OBJECTS.	SPATIAL DISTRIBUTION OF PHYSICAL OBJECTS; RESULTING SPATIAL PATTERN FORMED BY THIS DISTRIBUTION OF LANDFORMS, BLDGS, ROADS, PEOPLE; DISTRIBUTION IN SPACE OF VARYING QUALITIES OF PHYSICAL OBJECTS.

* ASPATIAL: "NO DIRECT CONCERN FOR SPATIAL PATTERN AT SCALE BEING FOCUSED UPON."



DONALD L. FOLEY, "AN APPROACH TO METROPOLITAN SPATIAL STRUCTURE" IN EXPLORATIONS INTO URBAN STRUCTURE.

4. A FORMAL DESCRIPTION OF PROCESS AND VARIABLES,

6. Communication Production of drawings, specifications, schedules, models, and so on. 1

Broadbent discusses the terminology of another researcher, P.H. Levin, who defines variables which relate to this process. These variables break down as follows:

- a) design parameters -- measurable, physical characteristics of each element in the design such as its area, length, location, the number of elements and so on;
- b) independent variables -- properties of the system over which the designer has no control, such as physical and mental characteristics of people, state of national economy, vagaries of climate;
- c) dependent variables -- all properties of the system that depend on the other two categories -- number of inhabitants, population densities, journey times, capital and running costs and so on. 2

Without evaluating Broadbent's and Levin's studies, one thing is evident: the decision-making process relating variables to design procedure is highly complex.

Another researcher, Harold Horowitz, has composed a simple list of planning considerations:

- 1. objectives of the master plan
- 2. special restrictions and limitations on design
- 3. characteristics of the site
- 4. site development requirements
- 5. functional requirements
- 6. characteristics of occupants
- 7. specific facility requirements
- 8. relative location and space inter-relationships

¹ Geoffrey H. Broadbent, "Design Method in Architecture," Architects' Journal (September 14, 1966), p. 683.

² Ibid.

- 9. budget
- 10. flexibility for growth
- 11. priorities 3

The ordering of this list seems to correspond with what might be the procedural order for developing the master plan, although the last three items in the list could be thought of as objectives under item (1).

Once again, these examples point out in a very general way the role of judgment on the part of the designer in approaching a problem. Although they show what steps may be taken to carry out design study, they do not begin to link in a rigorous way design variables to design process. Perhaps their conclusion and the conclusion drawn here would be the same. The relationship between design variables and design process is extremely difficult to define and is far beyond the scope of this thesis.

If design variables represent the factors which the designer must take into account, then design process is the way in which he considers and relates those variables. Looking again at Illustration #3, design process is the path taken by the designer through the field of variables. This field of variables at the community scale is what will be presented here.

³ Harold Horowitz, "The Architect's Programme and the Behavioural Sciences," Architectural Science Review, IX (September, 1966), pp. 71-79.

A community-scale design variable checklist is the object of this research. The term "checklist" reflects the purpose of this study. Rather than attempting to record every single design factor regardless of scale or importance, this checklist will aim at covering a broad range of considerations. Hopefully, the list will cover the breadth and not the depth of information. An analogy would be the making of a table of contents or outline as opposed to the writing of a detailed text.

The list will be open-ended. It is not possible to be certain of including all possible variables. Therefore, whatever emerges as a checklist will always be subject to additions and modifications as well as deletions. For a checklist to be useable, it must be manageable. It cannot be so long and so difficult to read that it will be just another reference book. It should be compact, sufficiently generalized to be scanned quickly, and readily understandable.

The format of the checklist should be such that the designer can both select variables to consider and chart out his strategy for design. In actual usage, the checklist will accompany the designer as he moves through the design process, keying his judgment as to those factors

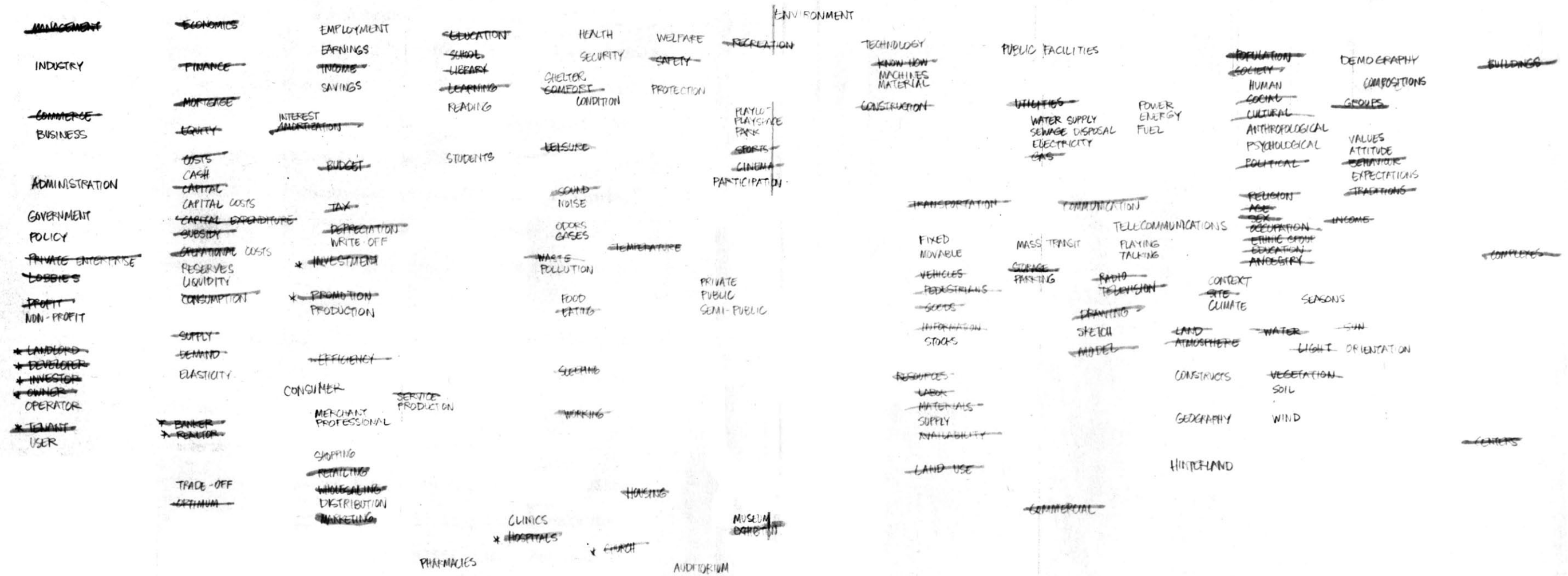
he must remember to deal with. It is very important to realize that such a checklist is a reminder and not a highly formalized information structure.

Collecting and Classifying Variables

The first step taken to generate the checklist was to collect in a random, unordered fashion variable names, regardless of their type or source. This was done by searching literature in planning, design theory, and community development and writing down quite literally those words which seemed to represent a design variable. At the same time, from experience and by free association, the master list of words was expanded. Eventually, a lengthy, totally unstructured list of words was compiled (Illustration #5).

The words ranged from "circulation," "maintenance," "contractor," and "liquidity" to "performance," "creation," "perception," and "prediction." This first list was intended to be formulated with a minimum of prejudice. Words overlapped in meaning, notions were duplicated, and scales were completely mixed. This master list was neither discrete in its jargon nor readable in its format.

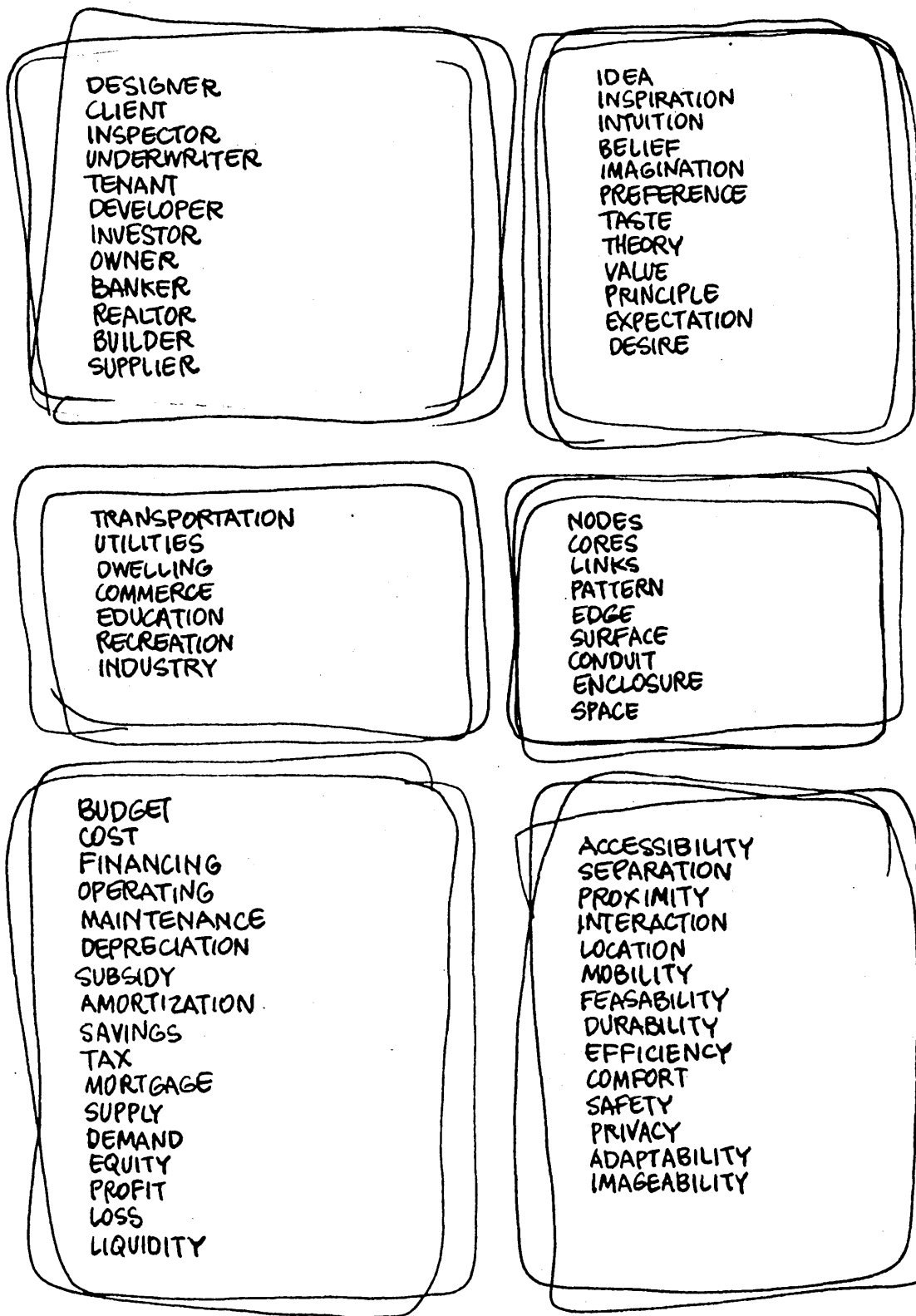
Having arrived, finally, at a point where very few new words could be added which were not already "collected,"



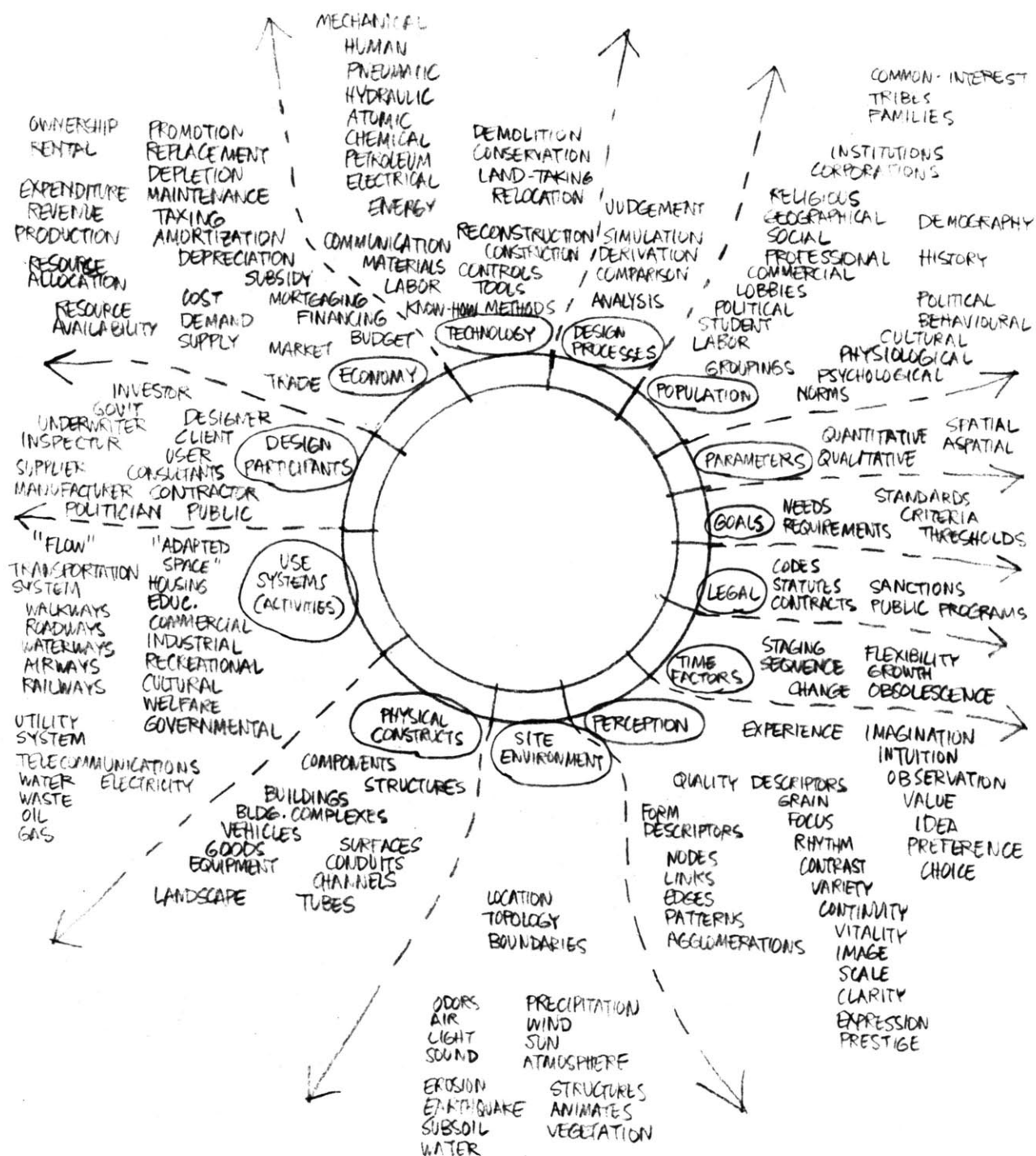
the next step was very much one of bookkeeping. This stage consisted of a series of passes through all of the variables in order to edit them and break the list down into rough groupings. The criteria for grouping words were essentially dependent on the association of meaning and of use with respect to design. The first few sets of variables were organized under headings such as "physical qualities," "time factors," "economic activities," "designer inputs," and "human inputs" (Illustration #6). Further editing and sorting produced more discrete sets with fewer words and somewhat more concise meaning.

Eventually, thirteen general categories of variables were identified. As mentioned previously, there is obviously no limit to the number of words or the number of variables that a category of information can contain. Moreover, the categories themselves are somewhat arbitrary and subject to interpretation. It is possible only to attain a certain degree of generality. What emerged then was a list of words arranged in such a way as to broadly reflect the breadth of factors related to community-scale design.

The format for recording this preliminary list was influenced by the design process. Recognizing design as a process of flow through a field of variables suggested



6. SOME VARIABLE GROUPINGS



1-11-67 SFL

7. THE ENVELOPING FIELD OF VARIABLES : OPEN-ENDED SETS .

arranging these variables non-hierarchically around the designer (Illustration #7). It is as if the designer were sitting in the midst of all of these enveloping issues. He must realize that they are unordered and that it is very much his responsibility to pull out and deal with those that he judges to be crucial. It should also be noted that the arrows radiating from the center suggest the open-endedness of this list. There are clearly more sub-variables that could be added to each of the general categories. Moreover, any particular design issue can be composed of several variables from several categories. For example, a decision about land acquisition implies considering, among others, economic, site, legal, and use variables. Graphically, it is necessary to think of these words and sets of words as being able to slide around dynamically, to be mapped on top of one another during use.

It is worth reiterating the semantic problem that list-making poses. The meaning of any word is subject to individual interpretation, and few words mean the same thing or suggest the same thing to different observers. Therefore, it might relieve anxieties at this point to explain briefly the meanings of some of these category headings. Presumably, this will make even clearer what the concept

of "design variable" signifies in the context of this study.

The reader will notice that some categories refer to physical components of environments. Others refer to aspects of environment which are nonphysical, referred to by Foley as "aspatial aspects," while still others refer to subjective inputs which affect the design process. The listing of what have been called "perception variables" represents the most subjective design input. Variables in this category relate to ways of describing or observing physical environment.

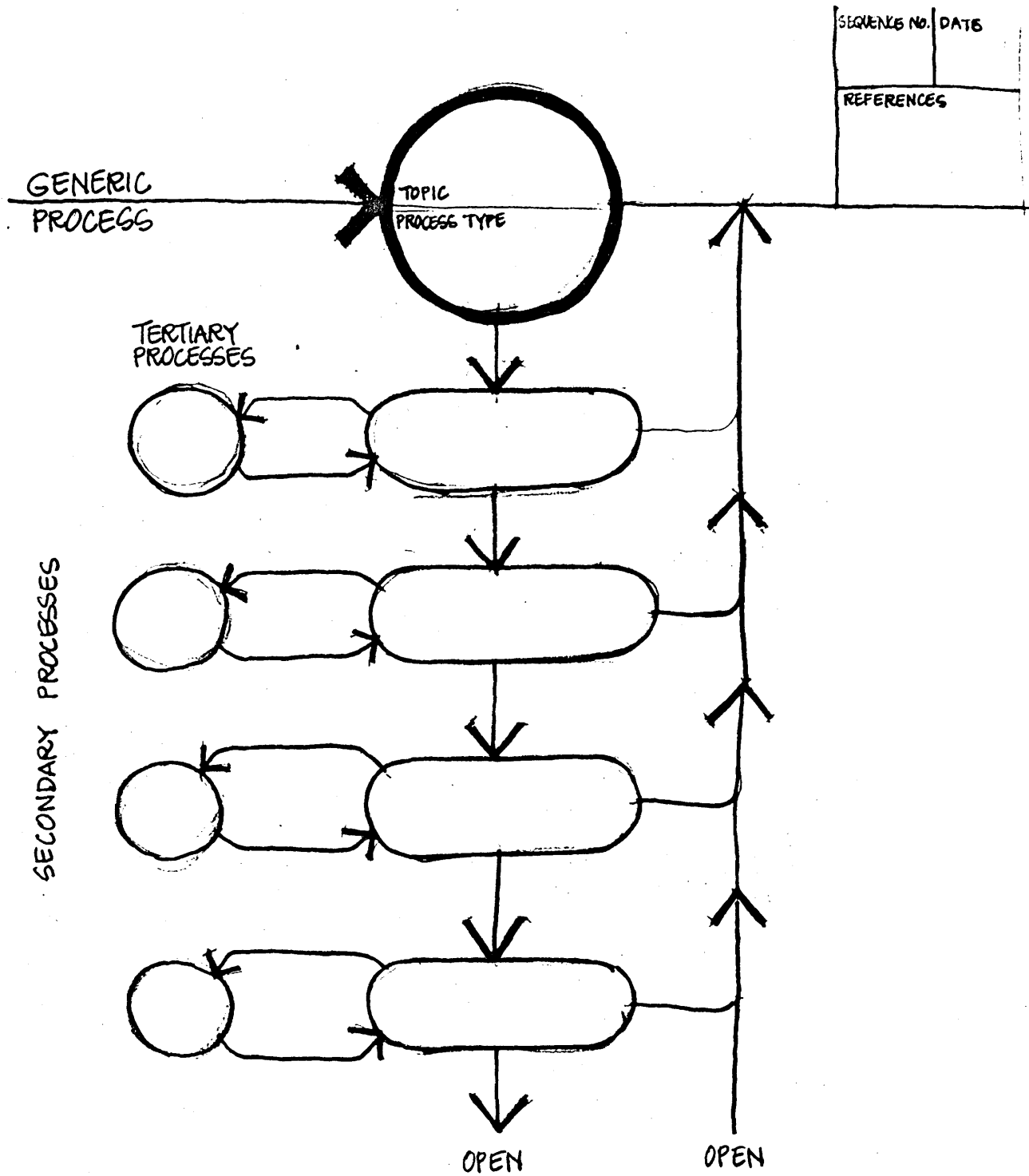
Economic variables are concerned with the provision, conversion, allocation or distribution of resources (labor, materials, land and money). "Use systems" refers to the product of design in terms of activities that occur, whether at small or large scale. These variables may be thought of as descriptive of the functional relationships that must be taken into account. Technological variables are those which are concerned with the construction, control or understanding of the environment by means of know-how, tools, materials and energy.

The notion of "goals" is an overriding variable set which deals with the desired performance of the final

product. Performance goals is merely a way of looking at the needs, objectives, limits, criteria, and so forth that influence the design process and product and which represent the overall problem statement.

Further refinement of the checklist was aimed at producing a somewhat more readable and usable version. There were word equivalencies or ambiguities which could be eliminated. For example, from the point of view of the information theorist, the concept of "goal," as mentioned above, can include "need," "expectation," "requirement," or "constraint," since they all act upon the decision-making process in the same way. One can only hope that there is enough breadth in these terms so that most people will agree on their general intent. The test of the list will ultimately depend on its being useful in describing many design considerations over a wide range of problems and designers.

Another element added to the format was a simple diagram which would allow the designer to chart his strategy or record his actions with respect to the variables. This amounted simply to an elementary, linear flow chart (Illustration #8). By relating each step in a design to a list of variables and a simple action



8. A DESIGN ACTIVITY FLOW DIAGRAM TO BE USED THROUGH TIME.

map, the designer might begin to have a useful, systematic tool.

The variable list was organized into five large sets: their headings were "information variables," "participants," "goals," "functional use systems," and "physical constructs." These sets were in turn broken down as shown in Illustration #9. One should view this new list not only as representing design variables, but also acting as a gate to raw data. If the designer were concerned with a problem for which he needed some technical standards relating to highway construction, he must in effect pass through the "gates" of "technological information" and "transportation systems."

This checklist, consistent with the above description of design process, moves through time with the designer (Illustration #10). Again, the user must connect the variables, select data, shift his area of attention, and make modifications according to his analytical and creative judgment.

Further editing continued refinement of the list and put it into an 8-1/2" x 11" format to satisfy the manageability constraint imposed earlier. In this way, one sheet of paper could easily be appended to the usually unmanageable mass of study and presentation papers.

PARTICIPANTS	
DESIGNERS	COORDINATORS, SPONSORS, CONSULTANTS
CLIENTS	EXPERIENCE IMAGINATION INTUITION PERCEPTION
UNDERWRITERS	INVESTORS INSURERS INSPECTORS
PRODUCERS	CONTRACTORS MANUFACTURERS SUPPLIERS

GOALS	
FEASIBILITY	PERFORMANCE
ECONOMIC	COMFORT SAFETY PHYSICAL PSYCHIC VISUAL ACOUSTIC ATMOSPHERIC SANITARY
TECHNOLOGICAL	ACTIVITY FUNCTIONS FIT CONTEXTUAL MODIFICATION
POLITICAL	CHANGE ABILITY
LEGAL	GROWTH REDUCTION

FUNCTIONAL ACTIVITY/USE SYSTEMS	
FLOW*	ADAPTED SPACE*
TRANSPORTATION SYSTEMS	INDUSTRIAL
ACTIVITY SYSTEMS	COMMERCIAL TRADE SERVICES RECREATION
	EDUCATIONAL PRIMARY SECONDARY VOCATIONAL UNIVERSITY
	DWELLING DENSITY COVERAGE OWNERSHIP/RENTAL CONTRACT/SELF HELP
	RECREATIONAL (NON-WORK) PUBLIC/PRIVATE OUTDOOR/INDOOR
	CULTURAL PUBLIC/PRIVATE
	WELFARE MEDICAL SOCIAL
	ADMINISTRATIVE PUBLIC/PRIVATE LOCAL REGIONAL NATIONAL
	AGRICULTURAL

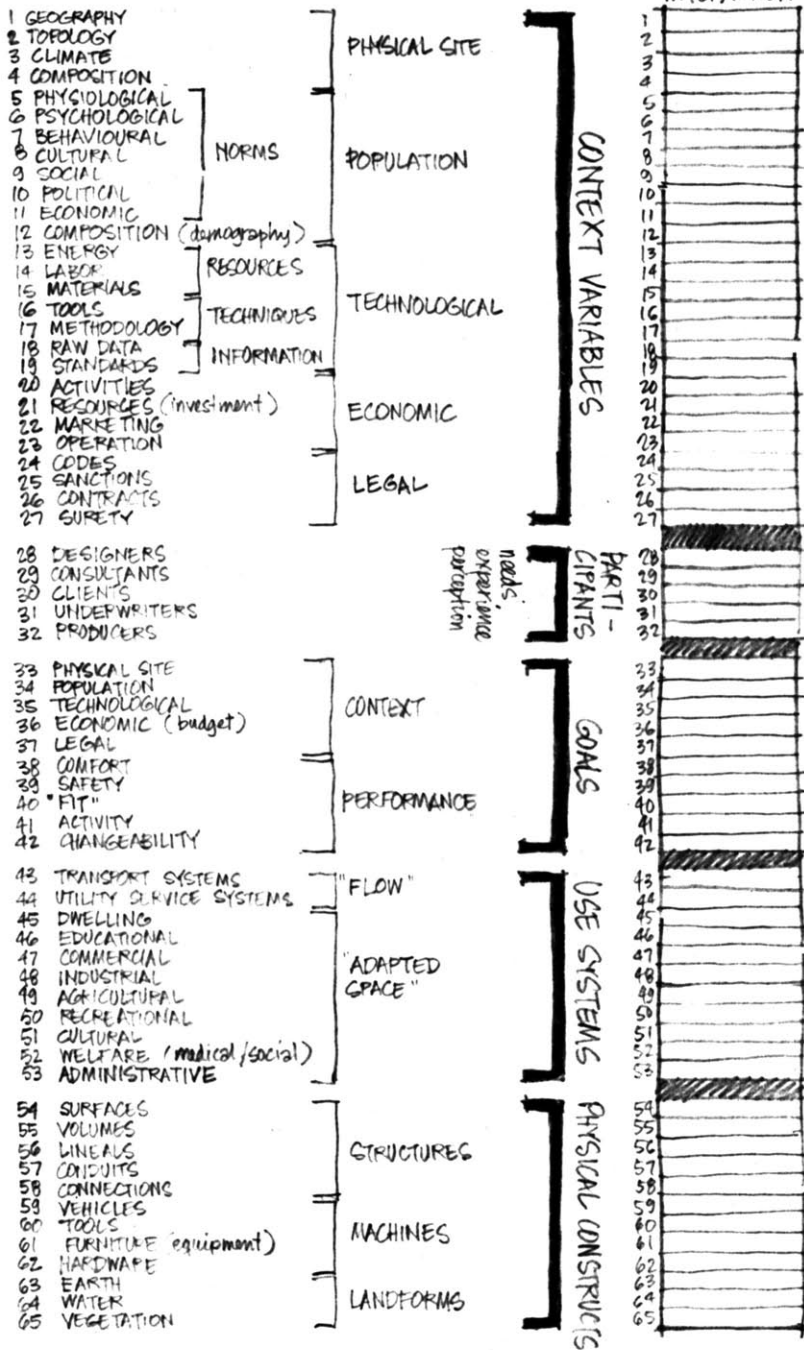
CONTEXT VARIABLES	
LEGAL	ECONOMIC
PUBLIC	PRIVATE
CODES SPECIAL ORDINANCES	CONTRACTS SURETY
ACTIVITIES EXTRACTION CONVERSION PRODUCTION SERVICES ADMINISTRATION	RESOURCES INVESTMENT FINANCING EQUITY MORTGAGE DEMAND PROMOTION FIXED COSTS OPERATION REVENUE
TECHNIQUES TOOLS TECHNOLOGY	TECHNIQUES TOOLS TECHNOLOGY
RESOURCES ENERGY LABOR MATERIAL	RESOURCES ENERGY LABOR MATERIAL
POPULATION INDIVIDUAL NORMS CULTURAL PSYCHOLOGICAL BEHAVIORAL SOCIAL NORMS COMPOSITION	POPULATION INDIVIDUAL NORMS CULTURAL PSYCHOLOGICAL BEHAVIORAL SOCIAL NORMS COMPOSITION
SITE GEOGRAPHY TOPOLOGY CLIMATE COMPOSITION	SITE GEOGRAPHY TOPOLOGY CLIMATE COMPOSITION
LOCATION ACCESSIBILITY EDUCATIONAL ORIENTATION STATE CONDOMINIUM	LOCATION ACCESSIBILITY EDUCATIONAL ORIENTATION STATE CONDOMINIUM
VEHICLES TOOLS FURNITURE	VEHICLES TOOLS FURNITURE
ENCLOSURES COVERINGS GOLDS FRAMES THIN MEMBERS TIRES CHANNELS WIRES	ENCLOSURES COVERINGS GOLDS FRAMES THIN MEMBERS TIRES CHANNELS WIRES
STRUCTURES	STRUCTURES
MACHINES	MACHINES
LANDSCAPE	LANDSCAPE

PHYSICAL CONSTRUCTS	
LANDSCAPE	STRUCTURES
EARTH	VEGETATION
WATER	VEGETATION
VEGETATION	VEGETATION
EQUIPMENT	FURNITURE
MACHINES	MACHINES
LANDSCAPE	LANDSCAPE
STRUCTURES	STRUCTURES
VEHICLES TOOLS FURNITURE	VEHICLES TOOLS FURNITURE
ENCLOSURES COVERINGS GOLDS FRAMES THIN MEMBERS TIRES CHANNELS WIRES	ENCLOSURES COVERINGS GOLDS FRAMES THIN MEMBERS TIRES CHANNELS WIRES
CONNECTIONS	CONNECTIONS

* FROM KEVIN LYNCH

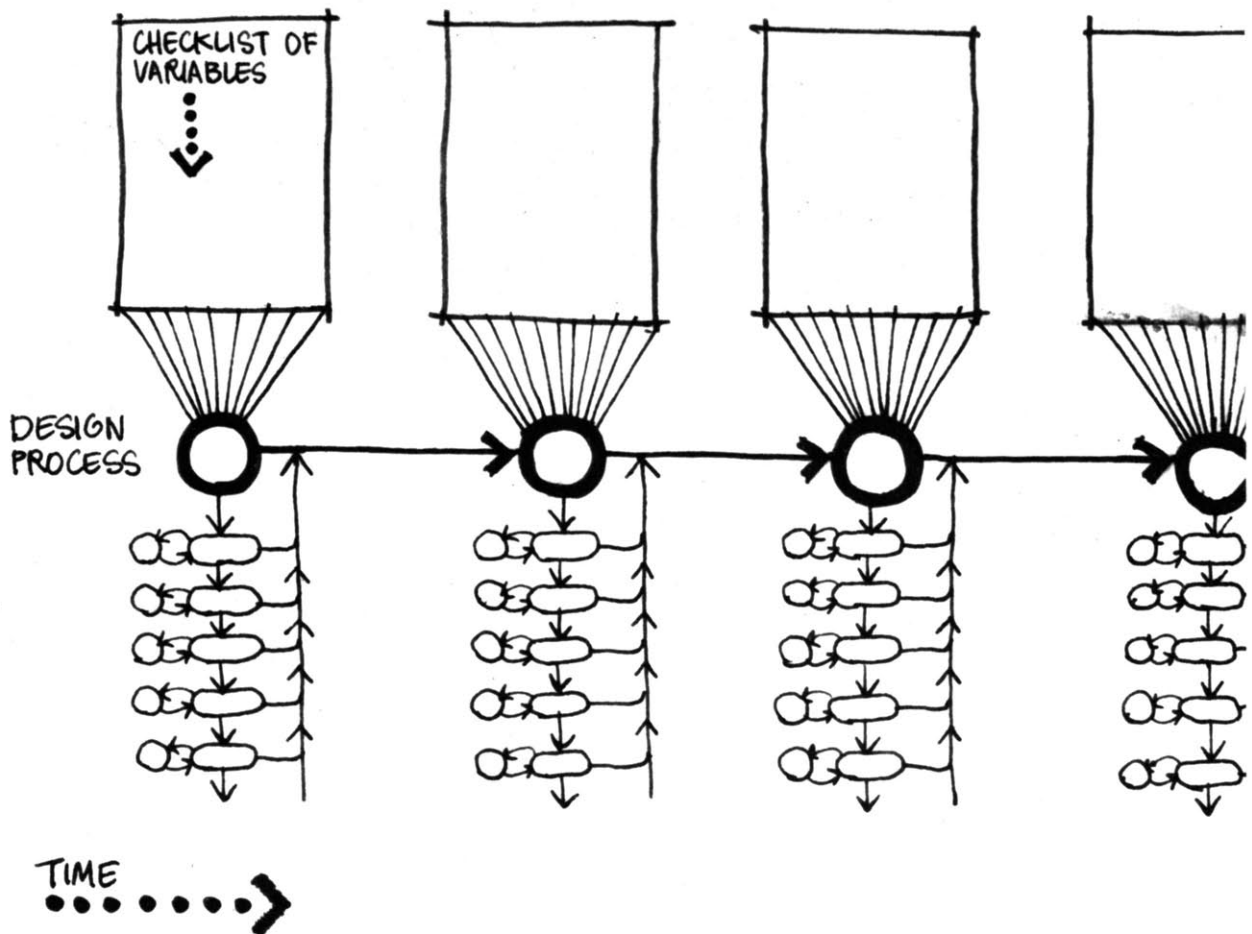
9. A PRELIMINARY VARIABLE CHECKLIST

GENERIC PROCESS



SEQUENCE DATE REFERENCES

CHECKLIST AND FLOW DIAGRAM IN SINGLE-PAGE FORMAT.



10. HOW THE CHECKLIST AND FLOW DIAGRAM FOLLOW DESIGN PROCESS.

This format still includes the flow diagram for charting steps in the design and provides for explicitly recording variable interactions. However, as was discovered in practice, this did not prove to be very useful. The variables explicitly named on this list do not go beyond a certain scale nor a certain level of detail. In fact, this level of detail is somewhat arbitrary and was influenced by the 8-1/2" x 11" format itself. As a practical consideration, space was provided for recording sequencing from one list to another, for dating, and for referencing to other lists or information sources.

At this point, any further modification of the checklist would result from its being applied and used, either in describing an already completed design study or in carrying out an ongoing study. A theoretically generated device inevitably changes as it interacts with reality. This mixing of research and application should minimize whatever abstraction had crept in.

PHASE TWO

Testing the Community-Scale Design Variable Checklist

An appropriate first step for investigating the usefulness of this checklist seemed to be in using it to describe an already completed design. Since the checklist is intended to be "community-scale," a large-scale project which is now under construction was analyzed. The analysis consisted of recording the history of the design process in collaboration with the architect and then using the checklist to map out, in terms of variables considered, the literal history. Matching the checklist to the history and charting a particular design process helped to eliminate errors and omissions in the checklist. Also, the testing demonstrated how this particular designer approached the design problem.

In 1963, Professor Horacio Caminos was asked to do the master plan for the University of Los Andes in Merida, Venezuela. The city of Merida is situated between two mountains and is topographically very constrained. The University already had several "branches" spread out on sites within the city and needed to expand considerably. There were a number of sites available in or near the city which the University could develop.

At the outset, the architect was given a very detailed program that had been prepared by a United Nations consultant. The consultant's study concentrated on describing the University's existing facilities and predicting needs for future growth. Moreover, the architect had only one summer to make his proposal for the new campus. Briefly, the architect had four phases to complete: 1) the determination of University policy and future building program; 2) the selection of a site or sites; 3) the proposal of a campus master plan; and 4) the design of prototype buildings. The ultimate building program would call for an essentially new development which would incorporate many community-scale facilities: classroom buildings, housing, administrative offices, commercial and recreational facilities, roads and utilities. Although the general problem may be thought of as "school" or "university" under the heading of "educational," the scale of the problem is clearly urban.

The literal history (that is, the history as described directly by the architect) is included here to demonstrate the full range of design issues and processes. Following this history is the checklist description which was done by identifying whatever variables appeared salient in the literal history, marking them on the checklist and

recording in a general way the design procedures (Illustrations #11 & 12).

Perhaps the most important observation resulting from this exercise is that at any one time the designer was coping with a large number of interacting variables. It is also evident that certain kinds of scale problems arose that required modification of the words used in the checklist. Obviously, there is still a great demand on the user to interpret and manipulate the generalized set of variables so that they apply to his particular problem.

A revised checklist resulted from these observations. In contrast to the previous list, the revised checklist includes as a separate category "temporal variables." Furthermore, this new list is changed in format to emphasize the open-endedness of sets of variables (Illustration #13). Thus, whatever words now appear may be added to or moved or deleted as necessary.

On the whole, this approach necessitates a certain familiarity with the terminology used. Assuming the user keeps the list in front of him and scans it periodically, he will presumably be reminded of the range of issues that he must consider, even if he chooses to associate

II. LITERAL DESIGN HISTORY

1) ARCHITECT RECEIVES WRITTEN AND VERBAL EXPLANATION OF NATURE OF PROJECT

2) ARCHITECT GOES TO VENEZUELA

(3) CLIENT REQUESTS AMOUNT OF WORK PRODUCEABLE IN 3 MO. HOW FAR?

3 MONTHS BEGINS

(4) ARCH. SPECIFIES WORK TO BE DONE CONTINGENT ON HELP AND INFORMATION AVAILABLE

(5) ARCH. PREPARES PRELIMINARY WORK SCHEDULE

- * based on time available
- * architect's experience

1st MONTH: PREPARE OVERALL PLANNING PROPOSALS: ALTERNATIVES

- * ROUGH PROGRAM
- * LAND USE PLAN
- * POLICY DEFINITION

OBTAIN APPROVAL OF CLIENT: SELECT ALTERNATIVE

2nd MONTH: PRELIMINARY DEVELOPMENT OF MASTER PLAN WITH CLIENT PARTICIPATION

- * LAND USE PLAN
- * PRELIMINARY PROTOTYPE BUILDING (MOST SIGNIFICANT BUILDINGS)

OBTAIN APPROVAL OF PRELIMINARY MASTER PLAN FROM CLIENT

3rd MONTH: PREPARATION OF FINAL PLANS, REPORT MASTER PLAN MODEL OF CAMPUS

OBTAIN FINAL APPROVAL OF CLIENT

MEETINGS & CONVERSATIONS WITH

- UNIV. MAINTENANCE OFFICE
- REAL ESTATE PEOPLE
- UNIV. EXECUTIVE (PRES.)
- ALL DEANS, ADMINISTRATION

ARCHITECT FORMULATES QUESTIONS TO FORMULATE POLICY

ARCHITECT DEVELOPS CLEAR UNDERSTANDING OF UNIVERSITY NEEDS, GOALS

GOAL: TO ENCOURAGE CULTURAL AND SOCIAL INTERCOURSE

VISIT TO UNIVERSITY SITE

- * SURVEY OF EXISTING FACILITIES (BLDGS.) & SITES IN CITY
- COSTS OF BLDGS.

AERIAL PHOTO

AERIAL CONTOUR MAP

PHOTOGRAPHED SITE

CLIMATE

MATERIALS & TECHNIQUES OF CONSTRUCTION

TOPOGRAPHY OF SITES

SOIL STUDIES

ENERGY

DRAINAGE

WASTE

WATER SUPPLY

JUNE 6

JUNE 12

TABULATES EXISTING PRINCIPLE CONDITIONS:

- * UNIVERSITY GROWING FAST (3200 in 1963, 6000 in 1968)
- * INADEQUATE FACILITIES TO MEET INCREASING DEMAND
- * EXISTING FACILITIES ARE SCATTERED MAKING UN-ECONOMIC FUNCTION
 - Parking Problem
 - Traffic Congestion
- * MEDICAL CENTER UNDER CONSTRUCTION HOSPITAL WITH 500 BEDS
- * SCHOOL OF FORESTRY UNDER CONSTRUCTION
- * SOME STUDENT & FACULTY HOUSING ALREADY BUILT
- * UNIVERSITY OWNS "EXCELLENT" SITES ON OUTSKIRTS
- * CITY CAN GROW ONLY IN ONE DIRECTION
- * HISTORIC BUILDING ON MAIN SQUARE
- * GLOBAL BUDGET FOR 5 YEAR DEVELOPMENT

ARCHITECT CLARIFIES & RECORDS UNIVERSITY POLICY FOR HIMSELF

CHECKS COSTS OF SITE DEVELOPMENT AGAINST BUDGET

MAPS OUT 5-10 ALTERNATIVES FOR LAND USE

CRITERIA

UNIV-UNIV (1). EFFICIENCY OF FUNCTION

- .INTENSITY OF USE OF SERVICES
- .SHARING OF FACILITIES
- .TRAVEL TIME

UNIV-CITY (2) INFLUENCE OF UNIV. ON CITY

- .INTEGRATION OF STUDENT & CITY LIFE
 - *COMMERCIAL
 - *CULTURAL
 - *70% STUDENTS LIVE IN CITY
 - *MUTUAL GROWTH TO BENEFIT BOTH

ARCHITECT PREPARES PRELIMINARY REPORT

ARCHITECT DRAWS FOR COMPARISON: TWO ALTERNATIVES

MAP OF CARACAS SHOWING CENTRAL UNIVERSITY AT SAME SCALE AS MERIDA.

JUNE '63

22 - 26

ARCHITECT TO DEVELOP PLAN FOR SITE

2 SITE PROPOSAL:

- SCHOOL OF FORESTRY
- BASIC SCIENCE
- TECHNOLOGY
- HUMANITIES
- LAW
- ECONOMICS
- ADMINISTRATION
- AUDITORIUM
- CENTRAL LIBRARY
- SPORT GROUNDS
- HOUSING

JUNE 22- JUNE 24

REDUCED TO 2 SIGNIFICANTLY DIFFERENT ALTERNATIVES:

- ALT A: CONCENTRATE AS M.A.P. THE CAMPUS ON ONE SITE
- ALT B: CONCENTRATE A.M.A.P. THE CAMPUS ON TWO SITES

PROS

CONS

ALT A: CRITERION 1

CRITERION 2

ALT B: CRITERION 1

SITE TIGHT FOR FUTURE

D.T. BECOMES C.G. OF UNIVERSITY TRANSPORTATION BETWEEN CAMPUSES FACILITATED ON EDGE OF CITY

OTHER SITE (ALREADY IN DEVELOPMENT)

- HOSPITAL
- SCHOOL OF MEDICINE
- SCHOOL OF PHARMACY
- DENTISTRY
- HOUSING
- SPORT GROUNDS

JUNE 24

PLANS SHOW DISTANCES

LAND USE

RELATIONSHIP TO CITY

6/22-6/24

CENTER OF CITY (EXISTING)

- UNIVERSITY EXTENSION
- EXHIBITION
- PROMOTION
- AUDITORIUM
- ADULT EDUCATION

PRELIMINARY REPORT:

- TO SELL PROPERTIES
- TO RENT PROPERTIES
- TO LEASE PROPERTIES
- LAND USE
- DISTRIBUTION OF BUILDINGS

DETAILED PROGRAM PRESENTED FOR EACH DEPT.
(FROM UN REPORT & FROM DISCUSSIONS WITH CLIENT)

NUMBER OF STUDENTS
NUMBER OF FACULTY
NUMBER OF ADMINISTRATION

ARCHITECT PRESENTS PROPOSAL
CLIENT APPROVES PROPOSAL

ARCHITECT DEVELOPS MORE DETAILED PROGRAM:

SCHOOL OF HUMANITIES
1450 STUDENTS
AREA/STUDENT: 12m² - BASED ON BUDGET RESTRICTIONS
+ 35% FOR CIRCULATION, SERVICES, SHOPS, CAFES
= 22,000m²
MOST OF PROGRAM CALLED FOR NEW FACILITIES

SCHOOL OF BASIC SCIENCE

SCHOOL OF TECHNOLOGY
AREAS ARE PROJECTED FOR NEEDS OF 1968
(5 YEARS HENCE) - FROM CONSULTANT
BUILDINGS TO BE EXPANDED 2X FOR FUTURE NEEDS
PARKING REQUIREMENTS
CIRCULATION
ACCESS

BUILDING CODES
PUBLIC WORKS REGULATIONS
GENERAL BUDGET STATED
Seismic
Fireproofing
Structural
Toilets
Stairwidths
Ventilation

DEFINE MAIN UNIVERSITY POLICY:

PREFER CONCENTRATION VS. DISPERSION
* ECONOMY OF CONSTRUCTION, SERVICE & MAINTENANCE
EFFICIENCY OF UTILITIES (IMPLICIT)
* ALLOW MAXIMUM USE OF FACILITIES, SHORTER DISTANCES
* TO CREATE AN URBAN ENVIRONMENT AS MAIN CHARACTER-
ISTIC OF LATIN CULTURE
* TO PROMOTE SOCIAL INTERCOURSE

POSSIBILITIES OF EXPANSION & GROWTH WITHOUT MOVING THE
C.G. AND PRESERVING THE UNITY AND ORGANIZATION OF THE
CAMPUS AROUND A FOCAL POINT

FLEXIBILITY OF USE OF BUILDINGS TO ALLOW FOR CONTINUOUS
CHANGES

JUNE 27 - JULY 27

ARCHITECT MAKES MODEL OF SITE
ARCHITECT MAKES VOLUMETRIC MODULES
REPRESENTING AREAS AT SAME (12" x
12" x 4") SCALE AS SITE (CARDBOARD)
ARCHITECT MAKES PARKING STRIPS,
ATHLETIC FIELDS REPRESENTING AREAS
TO STUDY SITE USE AND COVERAGE

ARCHITECT FEELS THAT OVERALL PLAN IS USELESS
WITHOUT STUDY OF BUILDINGS

TO DEVELOP OVERALL PLAN AS A WHOLE, IT IS
NECESSARY TO STUDY AND COORDINATE SIMULTANEOUSLY:

LAND USE
ACCESSIBILITY
PEDESTRIAN CIRCULATION
VEHICULAR
RELATIONSHIPS BETWEEN BUILDINGS
FREQUENCY OF CIRCULATION, ETC.
SHARING OF FACILITIES
WITHIN BUILDINGS:
FLEXIBLE, USEFUL AREAS (CIRCULATION)
FIXED UTILITY AREAS
CIRCULATION
STANDARDIZATION OF BUILDING ELEMENTS &
DIMENSIONS
TO INTEGRATE SHELTER & NON-SHELTER
SOLIDS AND VOIDS
STRUCTURES AND SPACES
GRADUAL SEQUENCE OF FOCUS GENERAL TO PARTICULAR
PUBLIC TO PRIVATE
ACTIVITY RELATIONSHIPS
STANDARDS OF PROXIMITY PREFERENCE

* SITE
AMPHITHEATRE
10% SLOPE (TOWARD CITY)
NATURAL BOWL LOOKING INTO CITY
SURROUNDED ON 3 SIDES BY MOUNTAINS
2500 FT. LONG (SLOPE ALONG LENGTH)
1500 FT. WIDE
250 FT. BETWEEN HIGHEST & LOWEST
POINT ON SITE
ACCESSES
ORIENTATION: NO RESTRICTION BECAUSE
WEST IS WELL PROTECTED BY MOUNTAINS
* CLIMATE
IDEAL, RESORT CLIMATE (AV. 70°F, 20°C)
NO MECHANICAL SYSTEM NEEDED - NO AIR CONDITIONING
MAY LEAVE GLASS OUT OF STRUCTURES

JUNE 27 - JULY 27

ARCHITECT ASSUMES: (EVIDENT TO ARCHITECT
BY COMPARISON)

* CIRCULATION
3 ALT (1) ONLY STAIRCASES - DISCARDED
VERTICAL (HEIGHT RESTRICTION)
(2) USING ELEVATORS - DISCARDED
(COST)
(3) STAIRCASES & ELEVATORS
MORTALITY RATES HIGH, THEREFORE ALT (3)
MOST EFFICIENT (TYPICAL IN ARGENTINA)
TO DEFINE ORGANIZATION & HEIGHT OF BUILDINGS
(3 TO 7 STORIES)

ARCHITECT CHECKS BUDGET CONTINUALLY: KNOWING
PERCENTAGE COST FOR EACH PART OF WORK TO
INSURE FEASIBILITY

JULY

ARCHITECT PREPARES LAND USE PLANS
BUILDINGS (HOUSING & ACADEMIC): PROTOTYPE ACADEMIC
PARKING AREAS (25% OF AREA)
SPORTS GROUNDS

* BUILDINGS ARE CONCENTRATED IN CENTER OF SITE IN NARROW
BAND TO REDUCE DISPLACEMENT OF PEOPLE - MINIMIZE VERTICAL
CIRCULATION

* PARKING LOTS HIGH UP SITE TO AVOID VIEW OF CARS FROM
BUILDINGS

* SPORTS GROUNDS DOWNHILL IN TERRACES TO BE DOMINATED
BY BUILDINGS

PERIPHERAL ROAD TO SERVE PARKING AREAS & BUILDINGS

GROUND FLOOR FOR SHOPS & CAFES
BASEMENT

COMPLEX FOR RECREATION: GYM, STUDENT UNION, DINING

COMPLEX FOR CULTURE: AUDITORIUM, LIBRARY, EXHIBITION
(THEATER)

PRELIMINARY INCLUDES:
* OVERALL PLANNING STUDIES
* PRELIM. STUDY OF TYPICAL BLDG.

AUGUST

LIST OF DIFFERENT ELEMENTS OF CAMPUS DEVELOPED
BY CONSULTANTS SIMULTANEOUSLY:

1) ACCESS ROADS FROM CITY	HIGHWAY	global
CAMPUS ROADS	ENGINEER	
2) WATER SUPPLY	HYDRAULIC	global
3) WATER DISTRIBUTION	ENGINEER	m ²
4) SEWAGE (WASTE)		global
5) STORM DRAINAGE SYSTEM		m ²
6) ELECTRIC POWER SUPPLY	ELECTRIC POWER	linear meter
7) ELECTRIC POWER DISTRIBUTION	ENGINEER	global
8) TELEPHONE SYSTEM		global
9) EXTERIOR FENCE		linear meter
10) PARKING AREAS	LANDSCAPE	m ²
11) EXTERIOR GRADING	DESIGNER	m ²
AND PAVING	(BY ARCHITECT)	
12) SPORTS GROUNDS		m ²
13) LANDSCAPING		m ²
14) SWIMMING POOL		global
15) BUILDINGS		m ²
(a) HUMANITIES GROUP		
(b) SCIENCE & TECHNOLOGY GROUP		
(c) SOCIAL & RECREATIONAL GROUP	ARCHITECT	
(INCL. UNION, GYMNASIUM)		
(d) CULTURAL & ADMINISTRATION GROUP		
(INCL. LIBRARY & AUDITORIUM)		
(e) HOUSING		

COSTS REPORT BEING PREPARED
FOR END OF AUGUST

STANDARDS
SOME GLOBAL
SOME UNIT COST

PRELIMINARY
DESIGNS OR
RECOMMENDATIONS

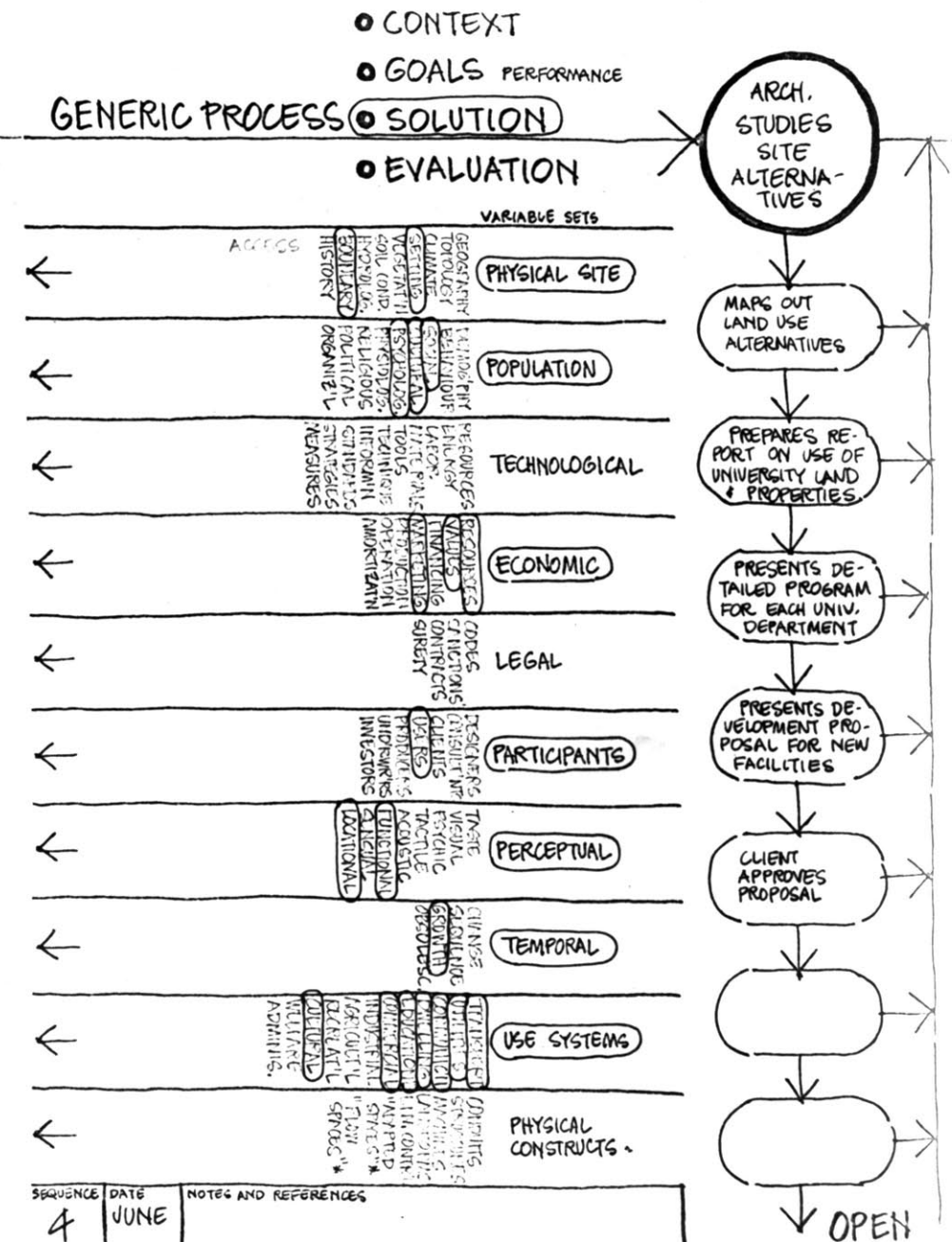
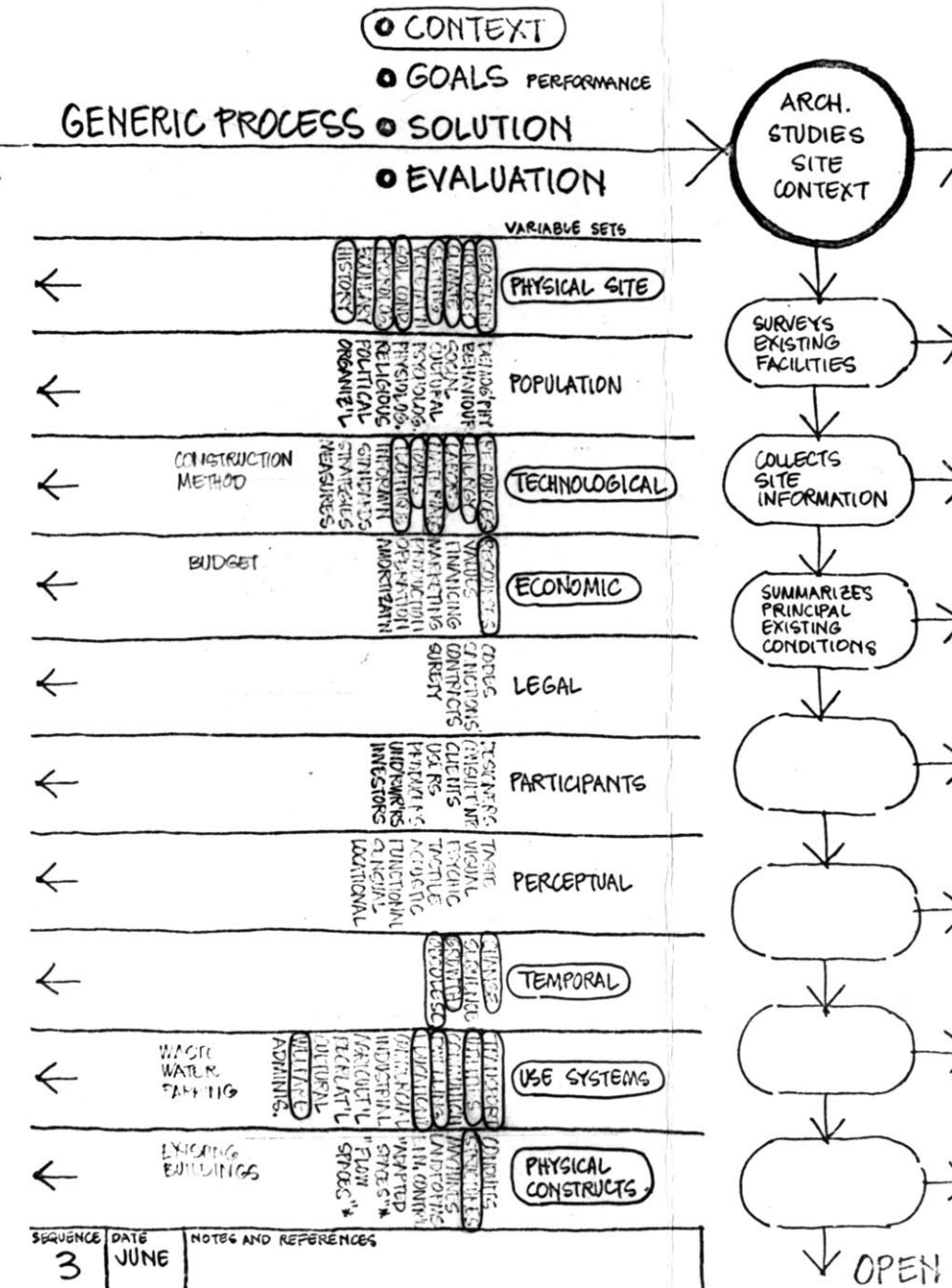
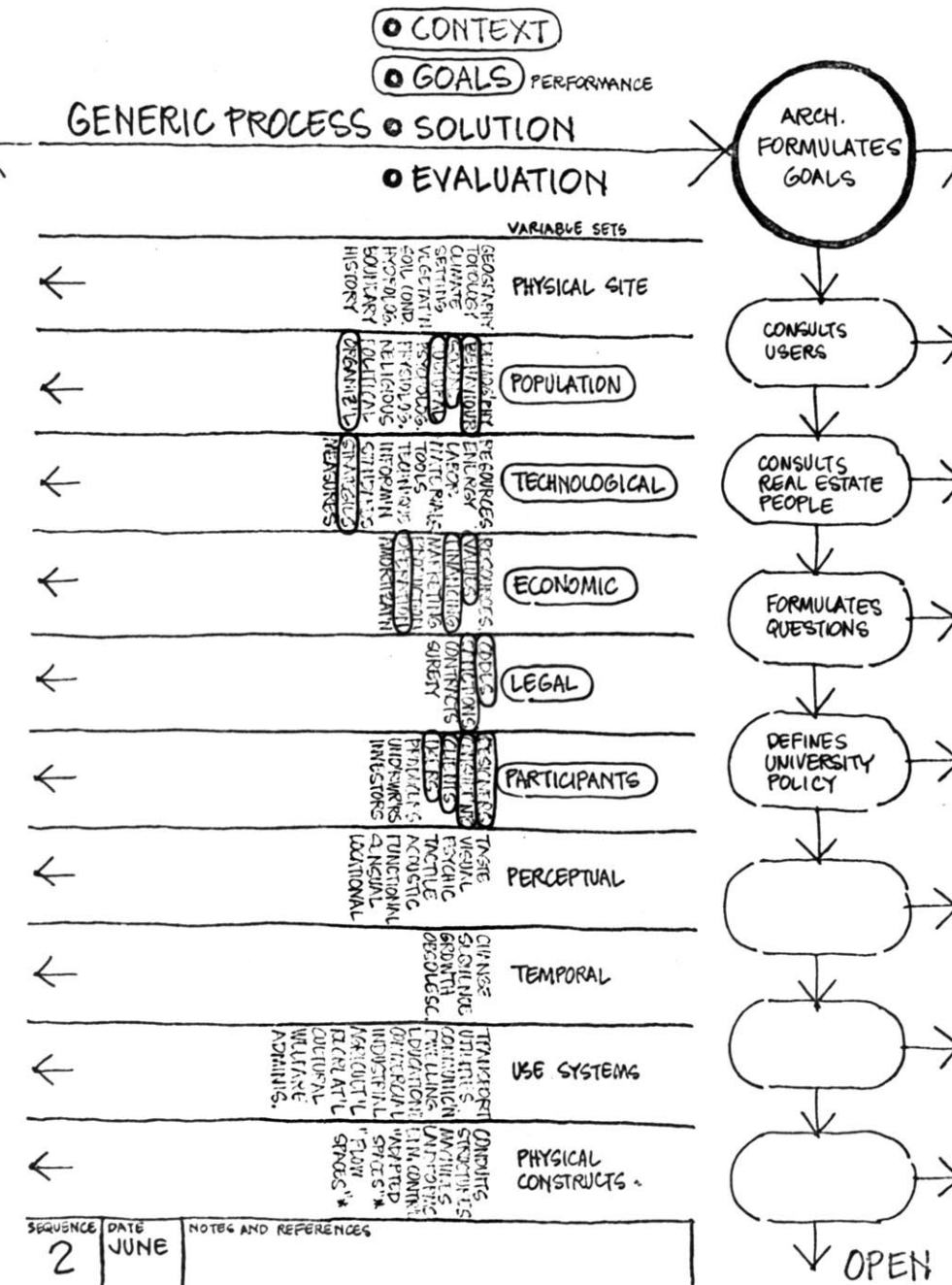
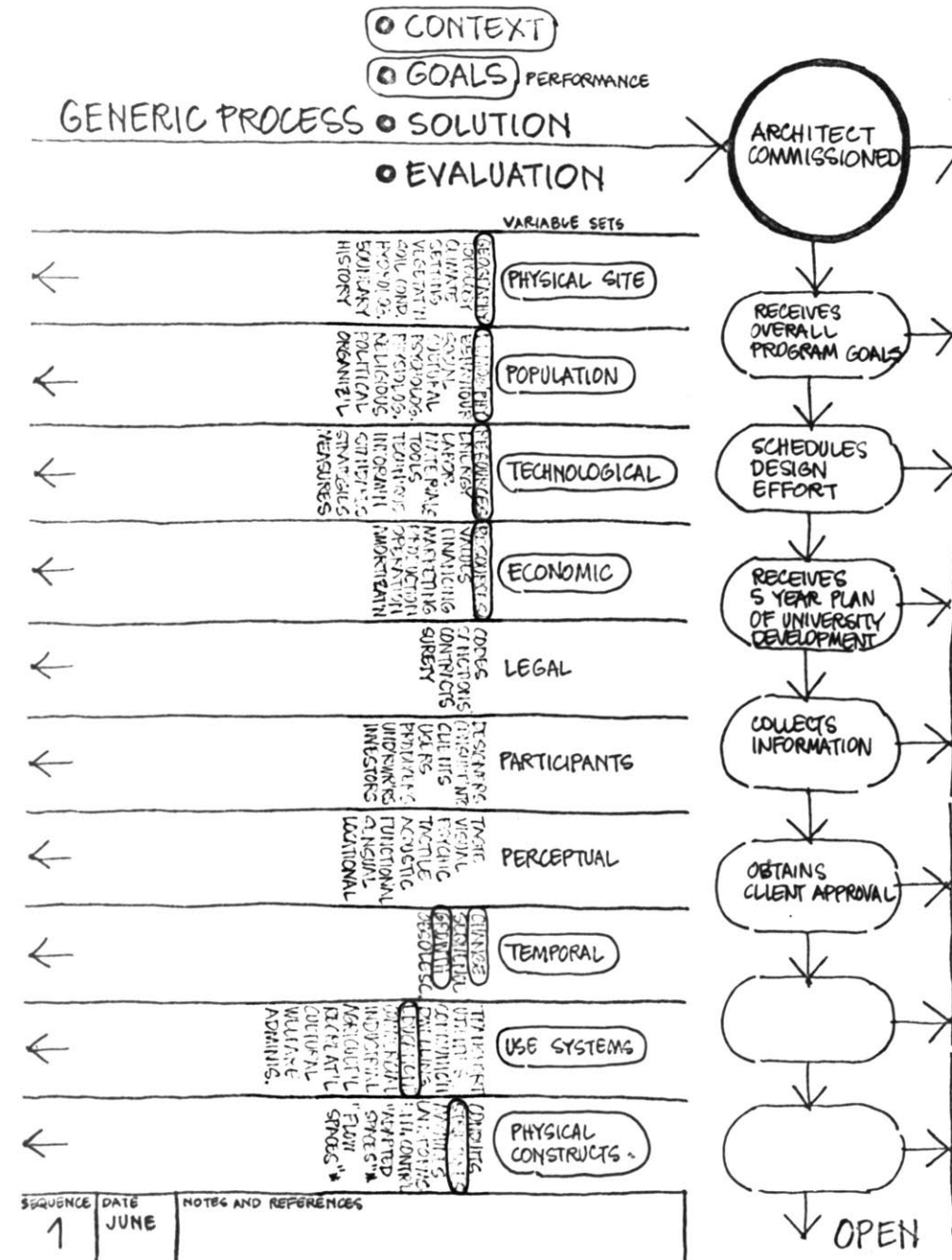
5 YEAR STAGING
(BUILDING USABLE
AFTER 3RD YEAR)

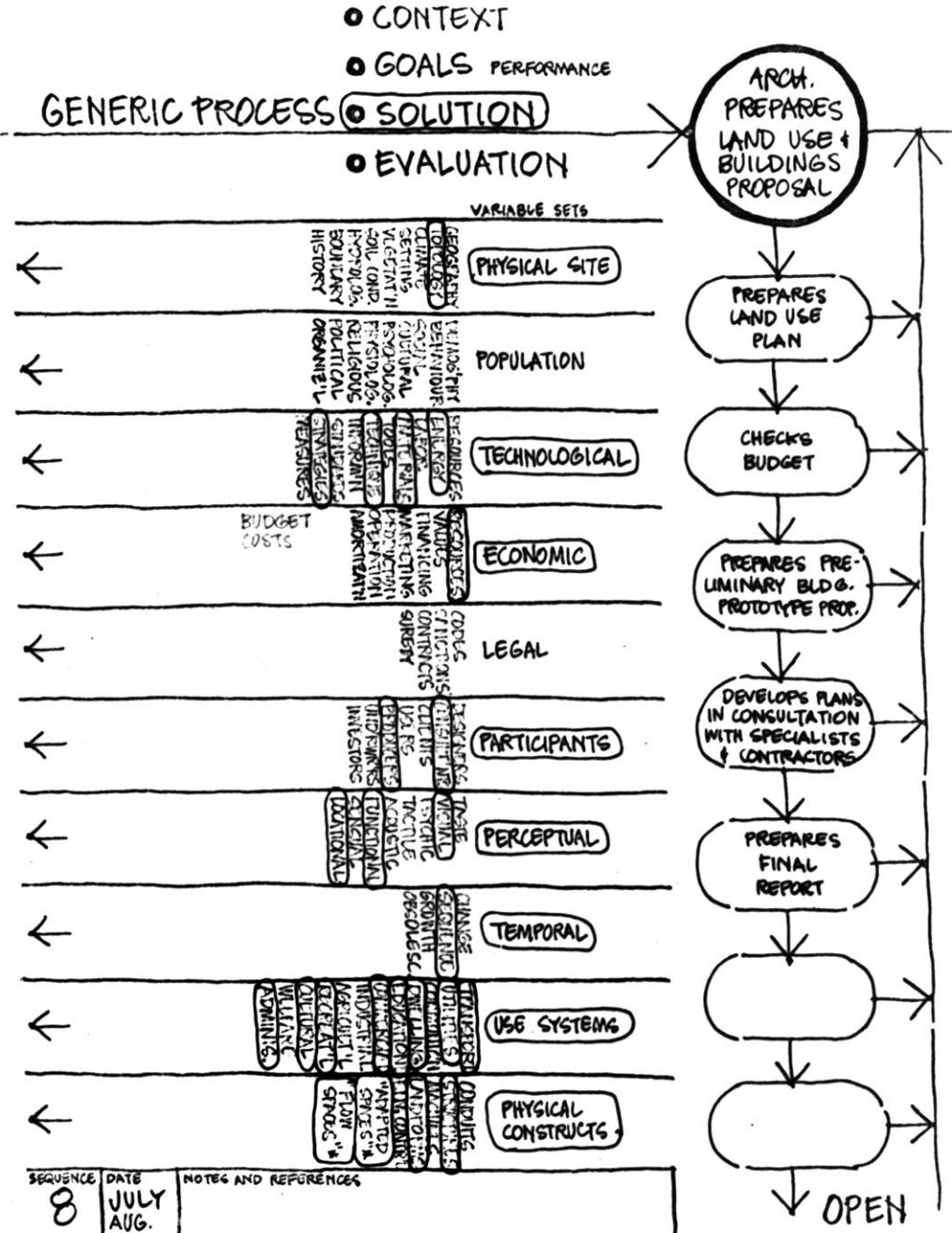
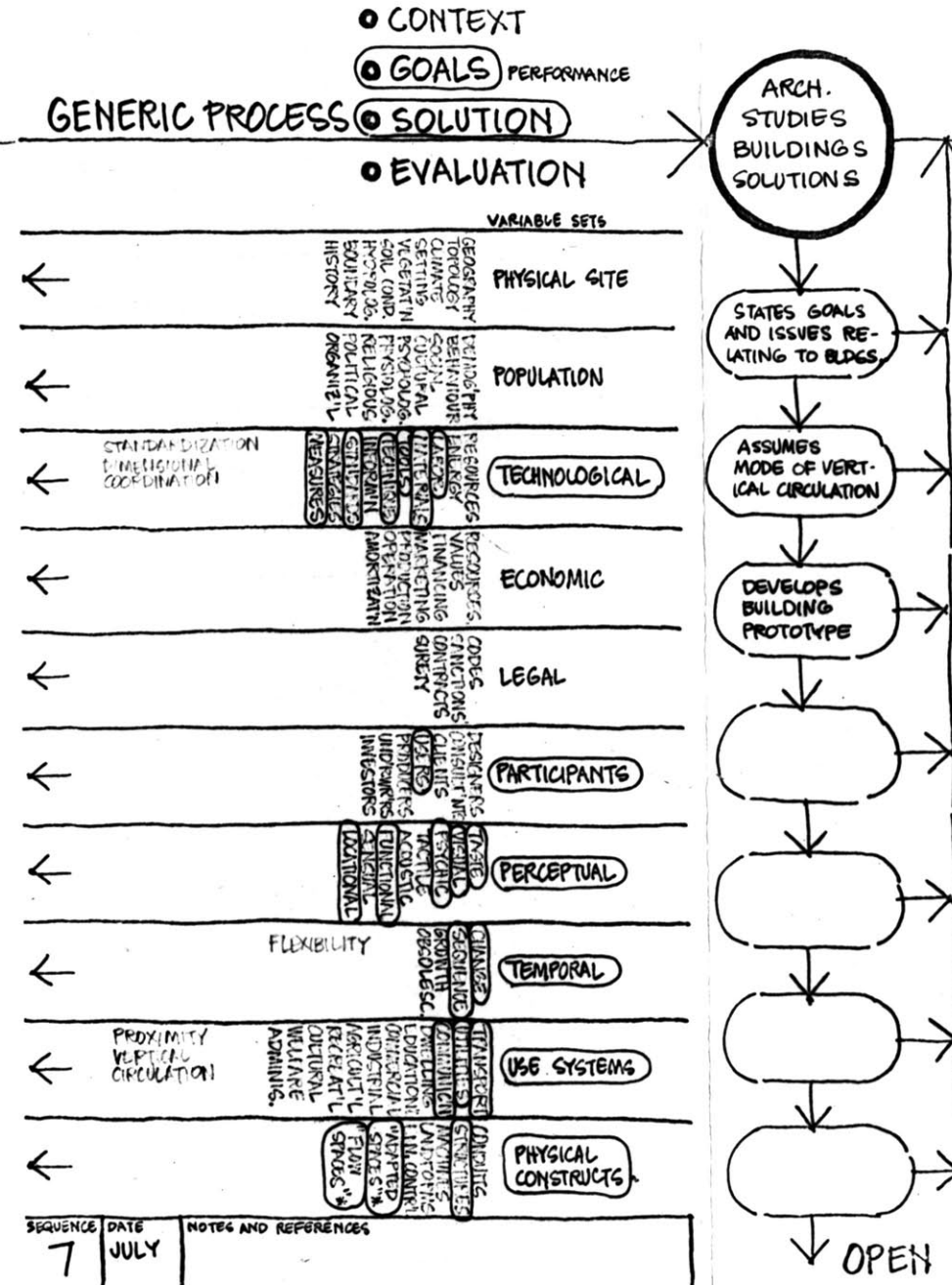
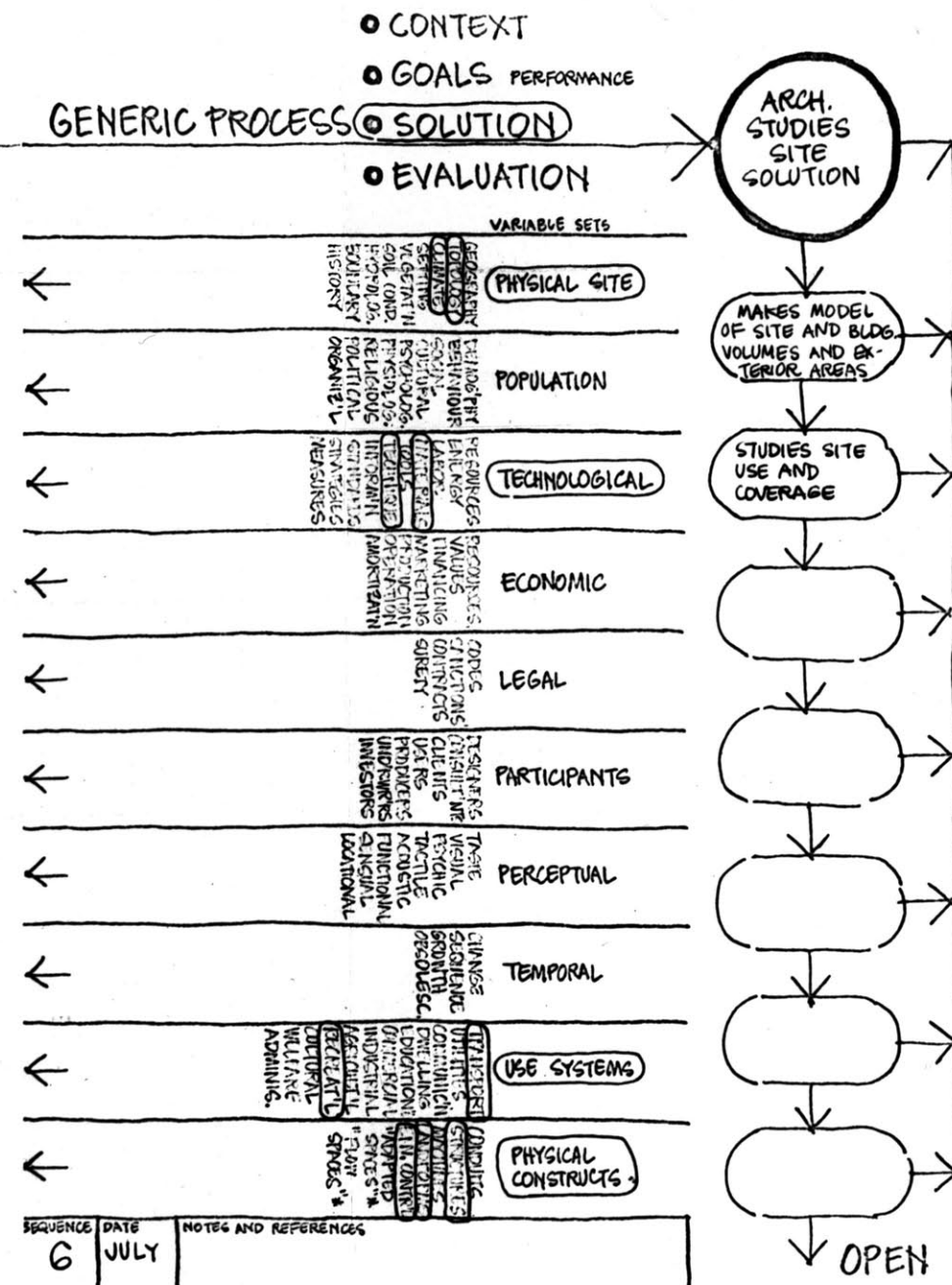
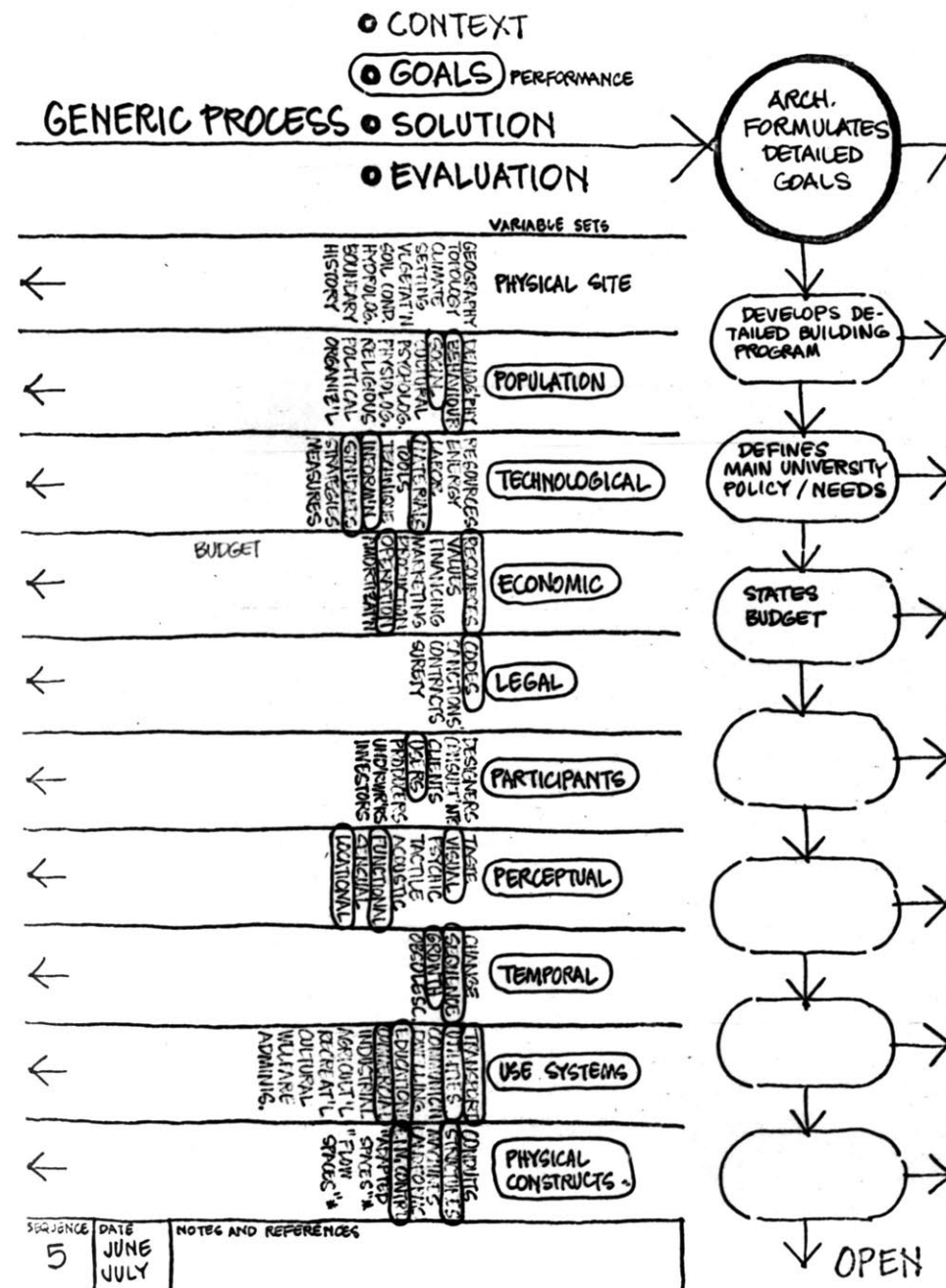
DISCUSSED WITH ENGINEER/
CONTRACTOR CONSULTANT

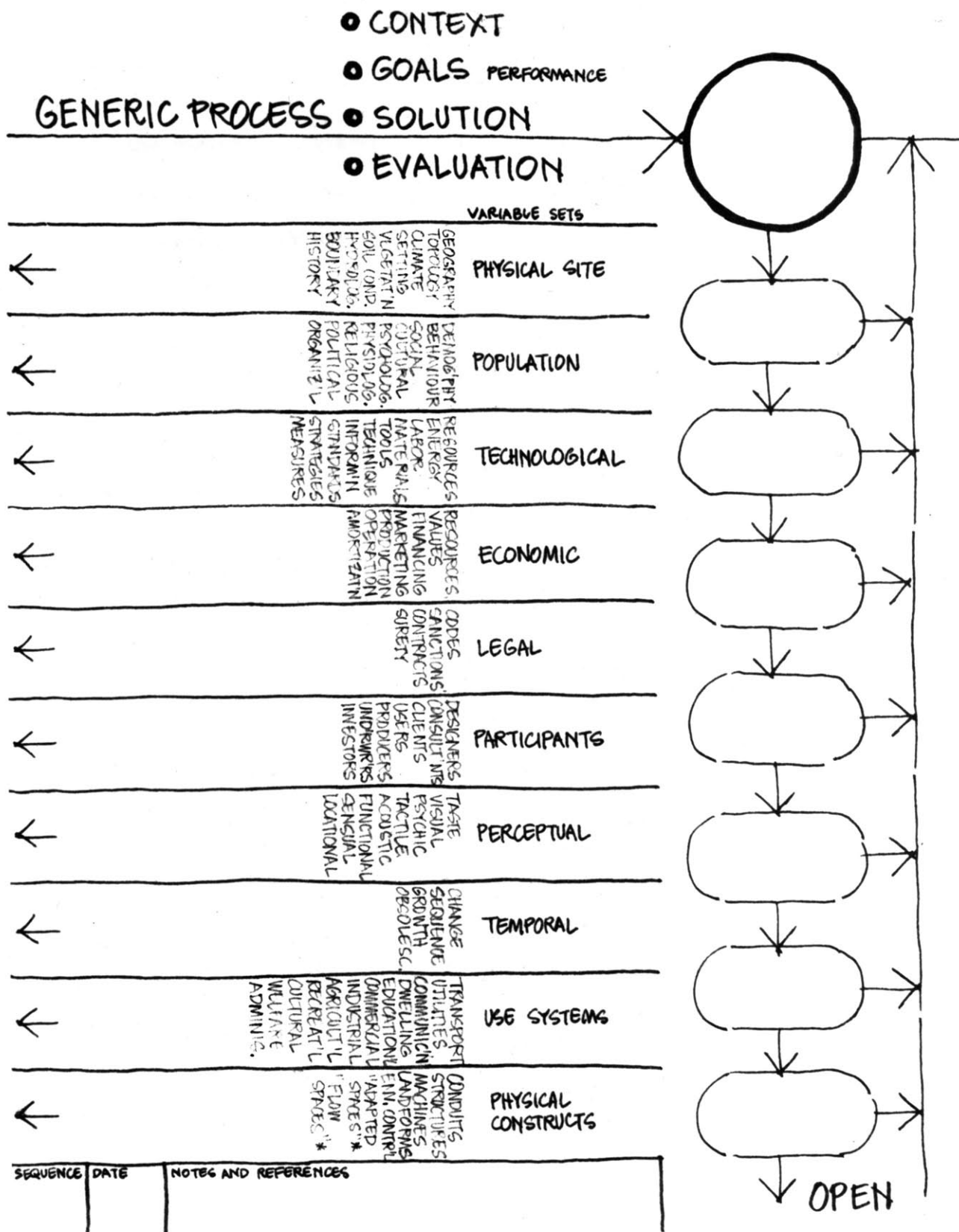
BASED ON PRACTICAL NEEDS

(1) ACCESS
(2) UTILITIES
SITE PREPARATION
BLDG. CONSTRUCTION.

12. CHECKLIST DESCRIPTION OF DESIGN HISTORY,







13. THE REVISED VARIABLE CHECKLIST.

the variables differently than they appear on the list.
Any factor of component or technique should somehow be
accommodated by appropriately "reading" the checklist.

PHASE THREE

Proposed Development of Nabeul, Tunisia

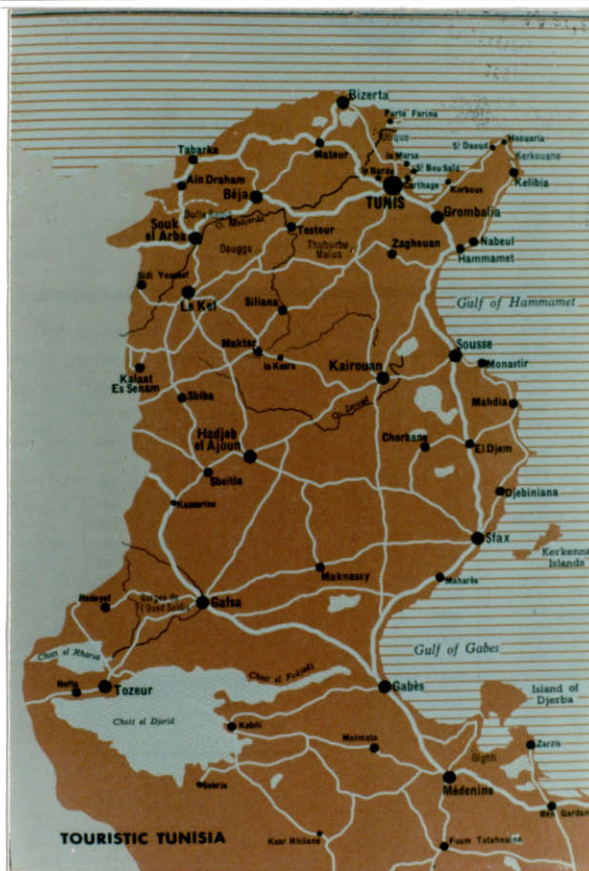
One of the greatest problems facing planners today is that of the ongoing urbanization in underdeveloped countries. It is a well-documented phenomenon that is associated with natural population growth, rural-urban migration, and increased labor specialization and industrialization. Unfortunately, the problem of community development in the context of underdeveloped countries is poorly understood, at least by western architects and planners. Frequently, an architect whose expertise is limited to building construction is called upon to be an "urbanist," responsible for planning large-scale projects and long-range development strategies with very limited resources. It therefore seems fitting to apply the design variable checklist to dealing with such a problem.

Because there was a limited amount of time, it was necessary to select a problem which was comprehensive and yet limited in complexity. I had the opportunity to spend two years living and working as an architect for the Public Works Ministry in Nabeul, Tunisia. So it seemed appropriate to study the development of this small community with which I was so familiar.

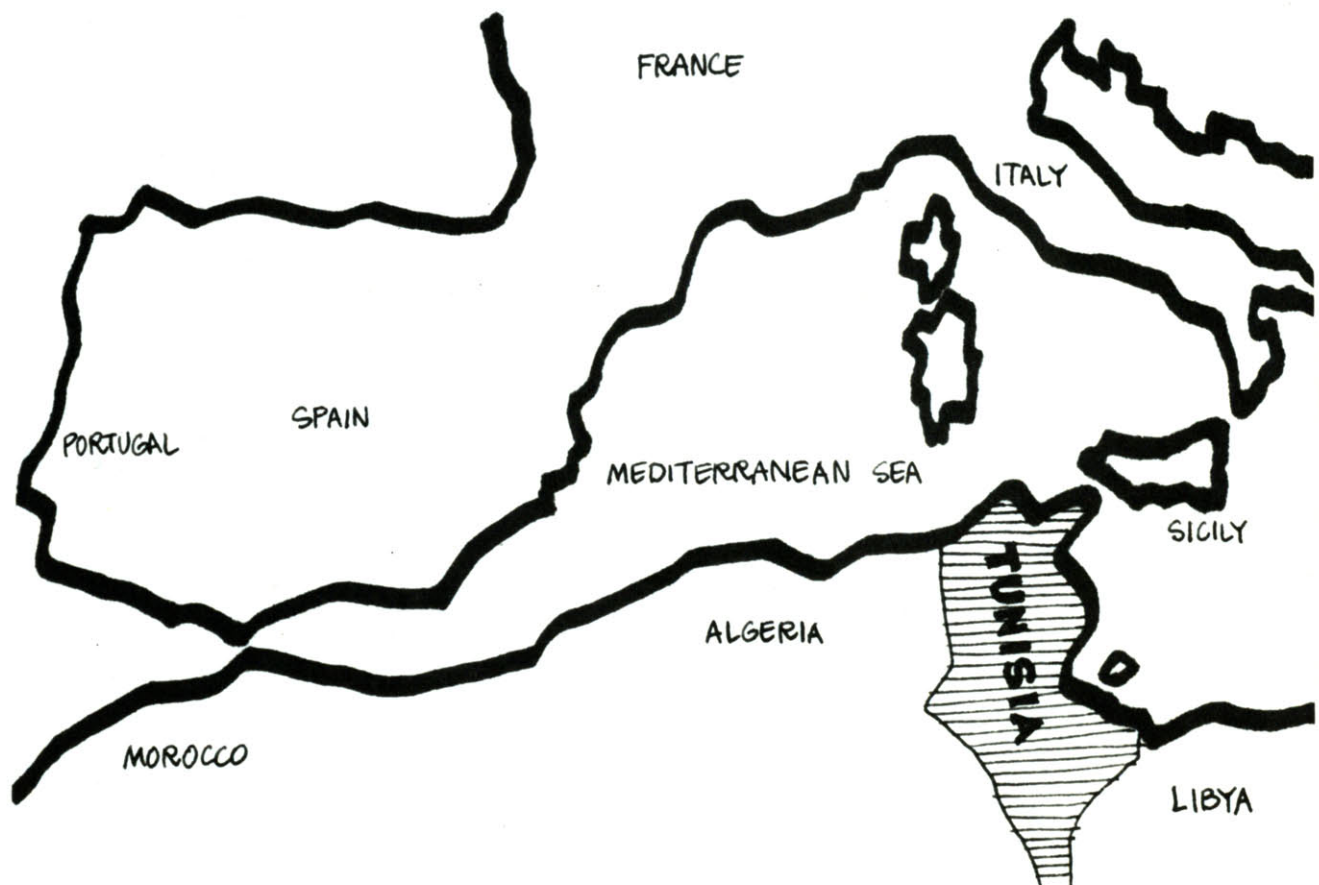
From the very beginning of this "application" phase the checklist was used both to map out the analytical approach as well as to develop the plan. The effort consisted of three parts: definition of problem context, analysis, and proposed solution.

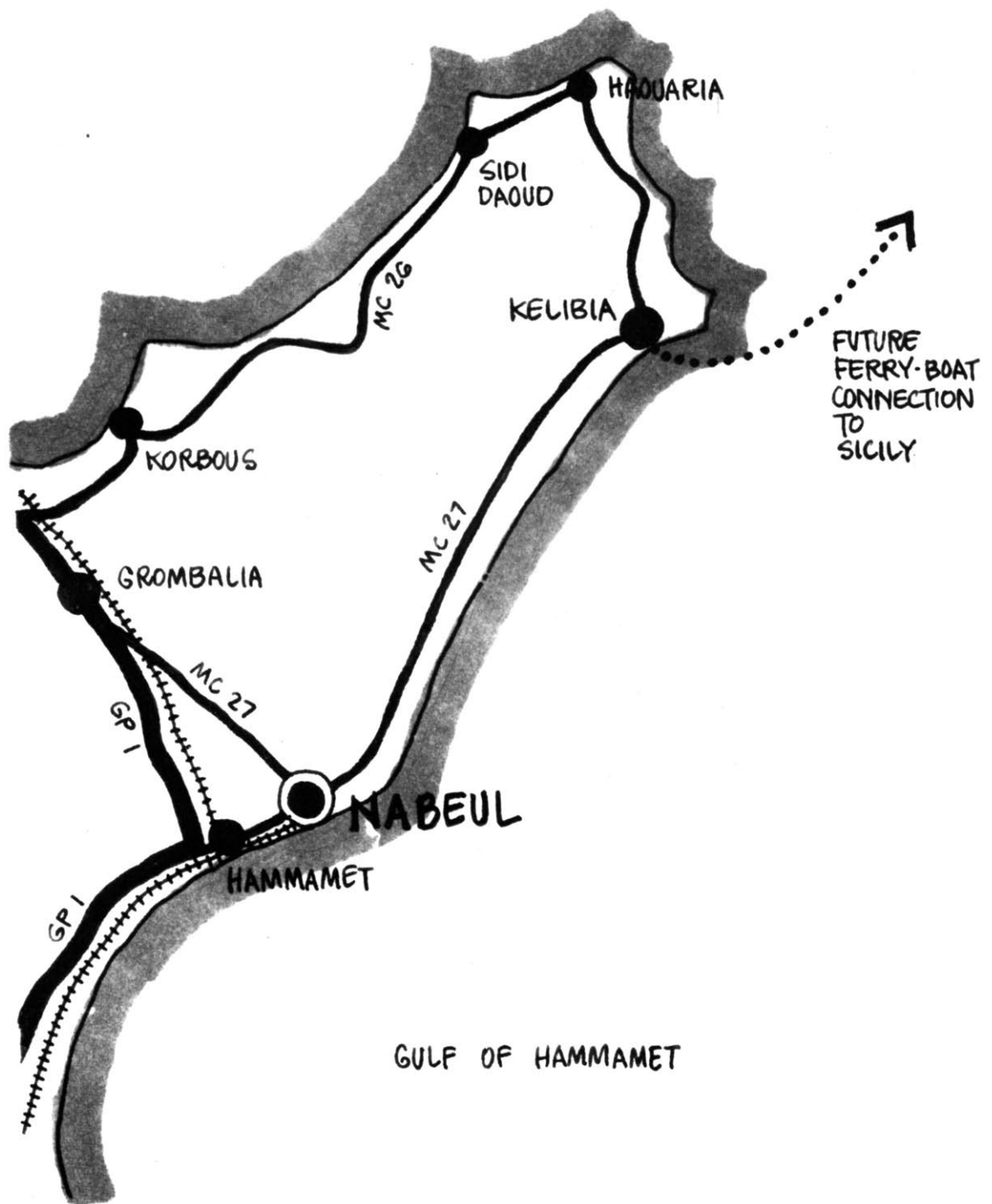
Tunisia is part of what ancient geographers called Barbary. Today it is one of the countries and ex-French colonies of North Africa. It lies about halfway between Gibraltar and Suez, just ninety miles southwest of Sicily, and is dwarfed by its neighbors, Algeria to the west and Libya to the southeast. The territory possesses a 750 mile coastline, most of which faces east to the Mediterranean. Its climate is pre-desert in the south and southwest and temperate Mediterranean in the north and east (see Map #14).

Tunisia faces the problem of people. The present population is estimated to be about 4.6 million with an overall density of 80 inhabitants per square mile and an annual growth rate of approximately 2.1%. Two-thirds of the population live in rural areas while roughly half of the urban population live in Tunis, the capital (600,000 inhabitants). Between 1930 and 1956, the urban population went from 17% to 30% of the total population.



14. MAP OF TUNISIA





15. MAP OF CAP BON

Tunisia is divided administratively into 13 regions or provinces, known as "Gouvernorats." The town of Nabeul is the regional capital of Cap Bon, the northeastern-most gouvernorat (see Map #15). The Cap Bon gouvernorat consists mainly of a peninsula 2900 square kilometers in area whose 280,000 inhabitants are almost completely rural. During the French protectorate, little was done to modernize this region in comparison to the rest of northern Tunisia and the southern coastal areas. Agriculture is, of course, the mainstay of the regional economy. In the last few years, the central government has initiated economic development plans which aim primarily at increasing agricultural and industrial productivity. The plans also take into account cultural and social problems which are largely responsible for the country's lack of development.

The town of Nabeul has changed very little in the last twenty years (see aerial photo #16 and model photo #17). Like most Arab towns situated near the Mediterranean, it had for centuries very little relationship to the sea which was less than two kilometers away. Most of the structures are built very close together, two to four stories in height, and typify the white, Mediterranean courtyard house. As can be seen from the aerial photo, the edges of the town are very distinct, with a fairly abrupt transition from



16. AERIAL PHOTO OF NABEUL.



urban to rural. The present municipality of Nabeul consists of what were once two separate towns: Nabeul to the south and Dar Chaabane to the north. Because of the sea and surrounding farmland and a natural tendency to internalize, both towns have expanded outwardly very little. Because of traditional rivalry, the two towns have never fused together.

The plan of existing transportation and utilities systems in Nabeul shows the principle vehicular circulation within the town and highways linking the town to the hinterland and other cities (see Appendix). The coastal highway running from northeast to southwest becomes the main street of the town. This highway runs all the way to the end of the peninsula, from where an eventual ferryboat line will connect North Africa to Europe by way of Sicily. Within the next several years, it is likely that the traffic load on this road will increase dramatically. Moreover, within the town there is serious conflict between the pedestrian circulation and vehicular circulation on this road, the locus of most of the town's commercial activity.

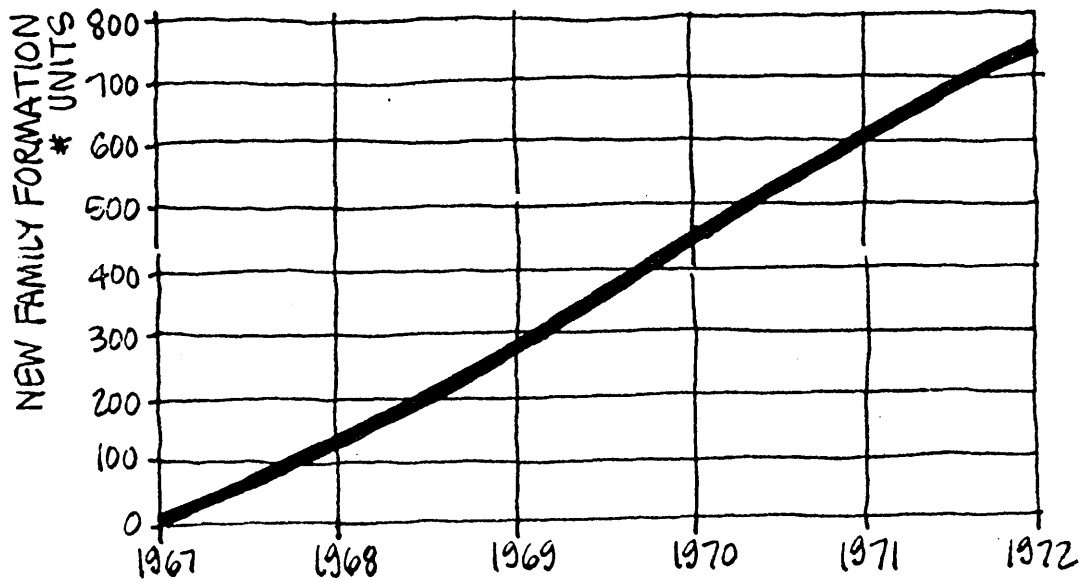
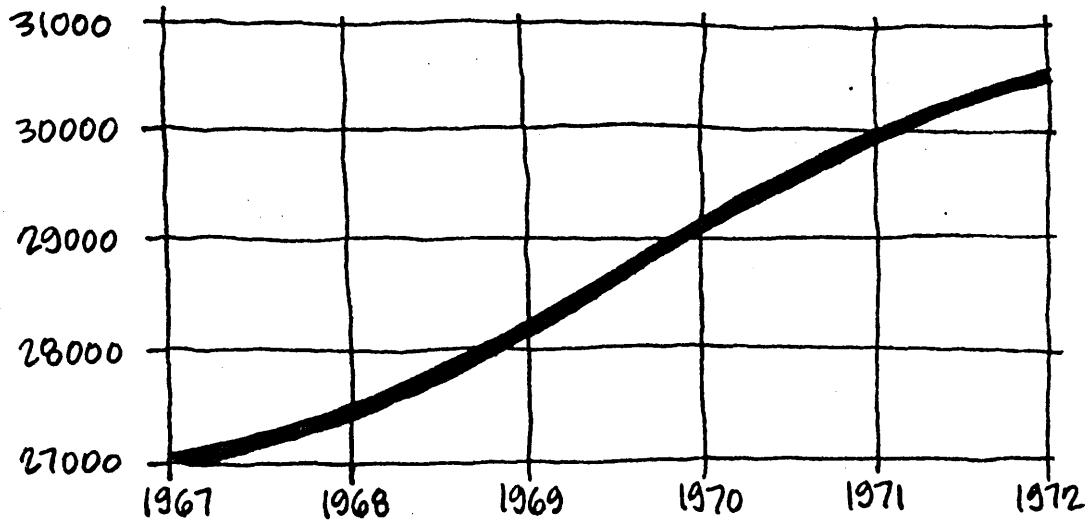
Nabeul has fairly good electric service. Buildings which are at present without electric current are easily accessible to it. Tele-communications facilities provide widespread but unreliable service. The most serious problem

with regard to utilities is that of water and waste systems. As can be seen from the plan (refer to appendix), the potable water supply and sewage line follow the paved roads without providing service to the less accessible, densely populated parts of town. Probably a majority of the houses depend on shallow wells for water and nearby cesspools or open gutters for waste elimination. This, of course, leads to contamination and considerable feces-born disease. The installation of proper water supply and sewage facilities is urgently needed.

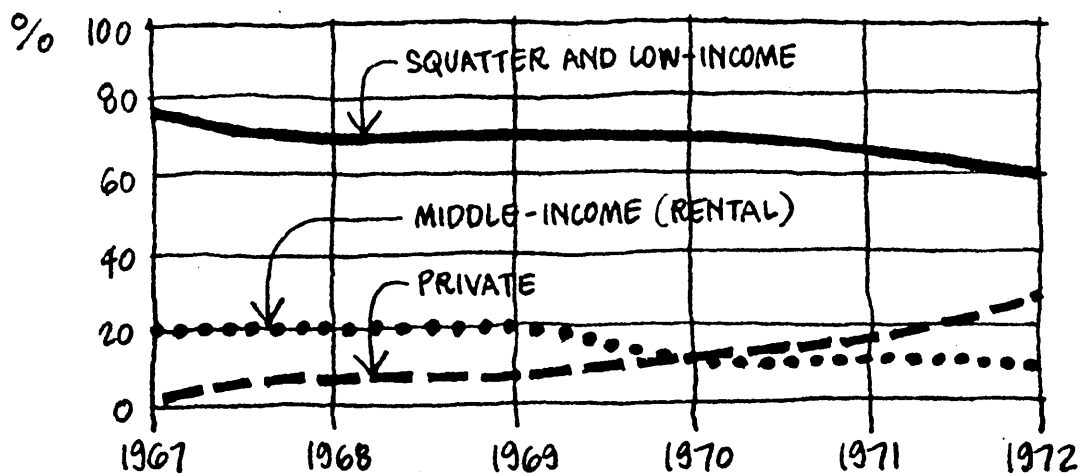
The population of Nabeul is almost all Arabic and engaged in agriculture or local commerce. Because of increasing governmental activity (Nabeul is the regional government seat) and commercial trade, the population of the town is growing at about 4% a year, of which about 1-1/2% results from immigration. The estimated population density of Nabeul is about 50 families per hectare. The average family, usually headed by a semi-skilled male laborer, earns from \$40 to \$70 a month, depending on how many other members of the family are working.

The people who move to Nabeul usually come for two reasons: to work as government civil servants or to rejoin relatives who are already living there. Presently, there

ESTIMATED POPULATION CHANGE



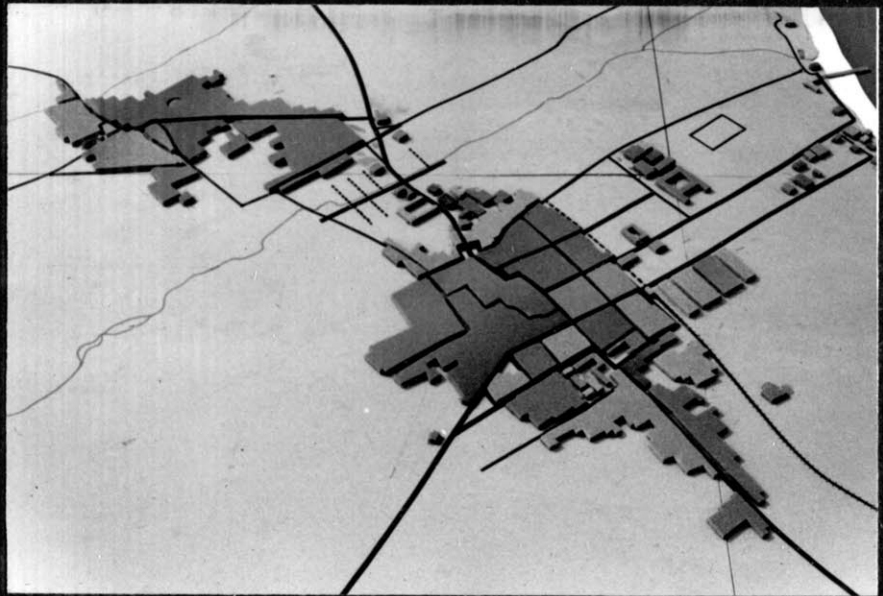
ESTIMATED COMPOSITION OF DWELLING NEEDS



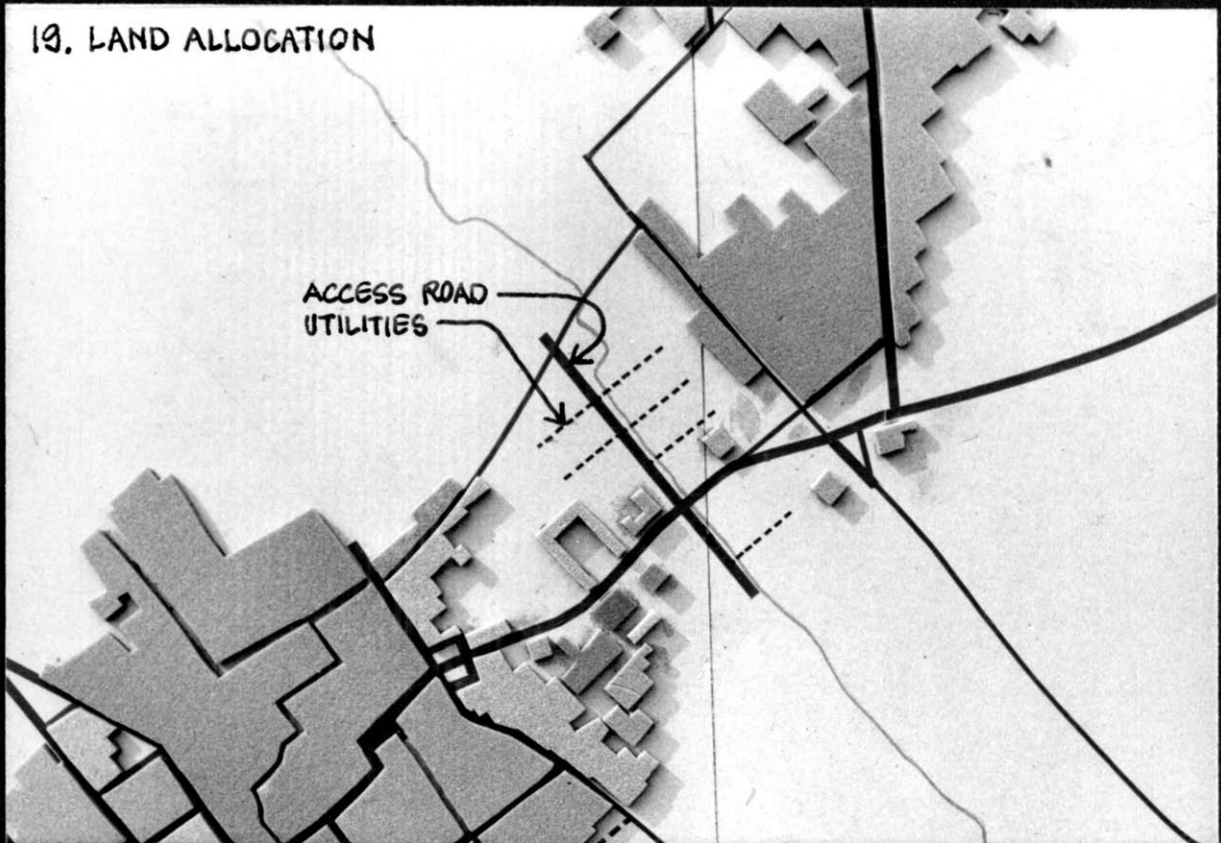
are very few squatter-type in-migrants. New family formation increases roughly in proportion to population growth. Family sizes vary from two to ten people (averaging six members per family). However, family size is expected to decrease in the next decade. Based on present estimates, Nabeul's current population of 27,000 will have increased to 30,000 by 1972. Over the next five years, this represents a need for 760 new dwelling units. The economic status of those needing new housing suggests that the 760 new units will be composed mostly of low and middle income housing with some squatter and privately built housing.

In a country where the few resources available must be concentrated on productive investment, the government cannot afford to build housing directly. It is assumed in this study that the existing stock of housing must be preserved. Tunisia simply cannot afford to think about replacement, but must instead concentrate on keeping abreast of its population increase with a minimum of expenditure. The squatter problem does not yet plague Nabeul. However, with the development of the region over the next several years, squatters will be coming into the area looking for work, and the problem could become worse.

One resource which the government has at its disposal for controlling and alleviating the problem of shelter,



19. LAND ALLOCATION



especially for low-income inhabitants, is land. This land adjoins the built-up area of the town and can be allocated for the construction of low-cost, self-help housing. The government's primary investment would then go into the provision of community facilities and basic utilities, as the accompanying photograph illustrates (#19). Some new housing will be built with government underwriting, but this too will be minimized.

After Tunisia gained its independence from France in 1956, one of its first major efforts was the construction of schools and the improvement of education. For about eight years, a large percentage of its resources was directed toward "scholarization." This is very obvious in Nabeul, where an immense regional high school has been constructed. There are adequate nursery and primary school facilities. Over the next five years, Nabeul will only need one additional nursery school and one or two new primary schools. The more serious problem will be the supply of qualified teachers.

Nabeul is the commercial center for Cap Bon. It is also one of the "artisanat" centers for the country, producing pottery for domestic use and foreign export. The "corner shop" is still very much the backbone of the town's commerce. Most commercial activity is either privately

run or run cooperatively with government "initiative."

Like housing, commercial facilities will grow at a pace determined by population growth and economic development. The small shop will proliferate along major circulation paths very much of its own accord. Larger enterprises will be formed as small business men get pressured by the government into consolidating. Regardless of whose initiative generates commercial activity, it demands physically the points of easiest access and most intense circulation.

It is undoubtedly the development of industry and agriculture which receive highest priority in Tunisia's planning. Nabeul has yet to fully exploit all available resources to encourage this development. At present, industrial activities are limited to the manual production of pottery goods, limited food processing and canning, and the extension of clay construction materials. All of these facilities could be advantageously expanded and modernized. The town could in fact become a major center for food processing as the agricultural hinterland increases its output. The region is an important producer of citrus fruits.

With some improvements in mechanization, the pottery-making potential of Nabeul could multiply manyfold. The

artistry with which goods are made has been proved readily saleable on foreign markets; Nabeul pottery is known throughout North Africa and Europe. The construction materials industry, largely dependent on available clay deposits and simple extruding machines, produces low-quality brick and construction tile. Improved methods of manufacture could make Nabeul a major supplier of Tunisia's construction materials, requiring little importation of raw materials. Foreign consultants also believe that good quality glass could be manufactured utilizing the sand found in this area. This would not only provide Nabeul with new industry and new jobs, but would also eliminate the need to import glass, one of the primary construction material imports taxing Tunisia's limited foreign exchange.

Although there is much to be done to speed up industrial development, Tunisia will still be dependent on the land. Cap Bon has fertile soil, but it is the victim of antiquated techniques and poorly controlled water resources. The government's major concern is the rationalization of farming. Whatever takes place in the urban areas will be linked to the improvement of farming. There is no technical reason why such efforts should not be successful. Northern Tunisia is very similar to some of the most valuable farmland in California. It is only a question of time and

attitudes before Cap Bon can be transformed.

One "bandwagon" that Tunisia was quick to get on is tourism, and with good reason. The beaches are better than most found on the northern Mediterranean, the climate is milder, the prices are lower, and the civilization is more interesting. Thus, Tunisia is presently enjoying a tremendous influx of foreign exchange, mostly from Germany, France, England and Scandinavia, as a direct result of efforts made to provide accommodations. Larger and larger investments are being made, both public and private, to keep up with demand and boost the economy. A coastal strip several hundred kilometers long has been reserved by the central government for the development of tourism. This strip runs south from the tip of Cap Bon to below the city of Sousse (see map #14). Ambitious plans for developing facilities are already underway, and Tunisia hopes to soon become the southern Mediterranean Riviera.

With tourism comes a certain amount of recreational activities suited to western tastes. However, for the average Nabeul citizen, recreation means going to the cinema, sitting at a cafe drinking tea, coffee or coca-cola, chatting at the public bath, or watching soccer at the "stade." Unfortunately, Nabeul has very little open play space and no park space at all. The preservation of "green

space" can be an effective means for controlling land rights for future developments as well as providing playgrounds. The one existing movie house is far too small for a town of 25,000 people, most of whose contact with the outside world is through pictures. As the town grows, some foresight will easily remedy these inadequacies.

One other recreational facility is worth mentioning. Once a year, Nabeul is the site of the national "Orange Tree Flower" Fair. The regional government has undertaken the construction of a large permanent fairground which will serve as a year-round trade center as well. It is a dubious expenditure in the light of more pressing economic and social needs. However, it is highly "image-producing," and in the Islamic society of Tunisia, that is often the trade-off that is made.

A major source of activity for Nabeul derives from the government and its various administrative and welfare activities. The ministry of health has built and is currently staffing a large, regional hospital. Although widely scattered throughout the town, all of the agencies and government functions will eventually be housed in a new government center (another dubious expenditure). There will also be strong demand for another PTT branch now

that Nabeul includes the former municipality of Dar Chaabane. As indicated earlier, many of the people moving to Nabeul are "fonctionnaires" who will staff these facilities. Thus, there is a good correspondence at this point between the demand for new housing and community facilities and the creation of new jobs.

Of special interest is the role, or lack thereof, of the banking system in Tunisia. One of the keys to economic development is the formulation of capital by savings. Without savings, there cannot be financing, and without financing, there is no investment. Unfortunately, a Tunisian views banks in the same way as most of the people in underdeveloped countries. He sees them as instruments of government. Money on paper, or credit, have no real value to him. Therefore, whatever capital is accumulated is quickly put into the mattress or, if possible, into gold or jewelry. The result is, of course, that mortgages are unheard of, interest rates are intolerable, and much investment capital comes from abroad. If a grass-roots level saving habit could be formed, and if people's confidence in and understanding of banks could be increased, much progress would be made toward the establishment of financing mechanisms essential to economic growth, and particularly physical growth.

Therefore, any community plan should view the provision of banks or lending institutions as a basic community facilities not to be overlooked.

This background discussion has been brief and is intended to provide a sketch idea of the context for design. Many of the details that go into formulating a development plan were implicitly, rather than explicitly, taken into consideration. It is from this context that overall and specific operational goals were assumed and from which the final proposal was made.

Below are tabulated the macro-objectives to be met by the development proposal. These goals are very general; yet they act as both guidelines and criteria in generating and evaluating a solution. From these, and after analysis of the Nabeul "context," a particular development strategy emerged showing new facilities and how they relate to time and population growth.

OVERALL GOALS:

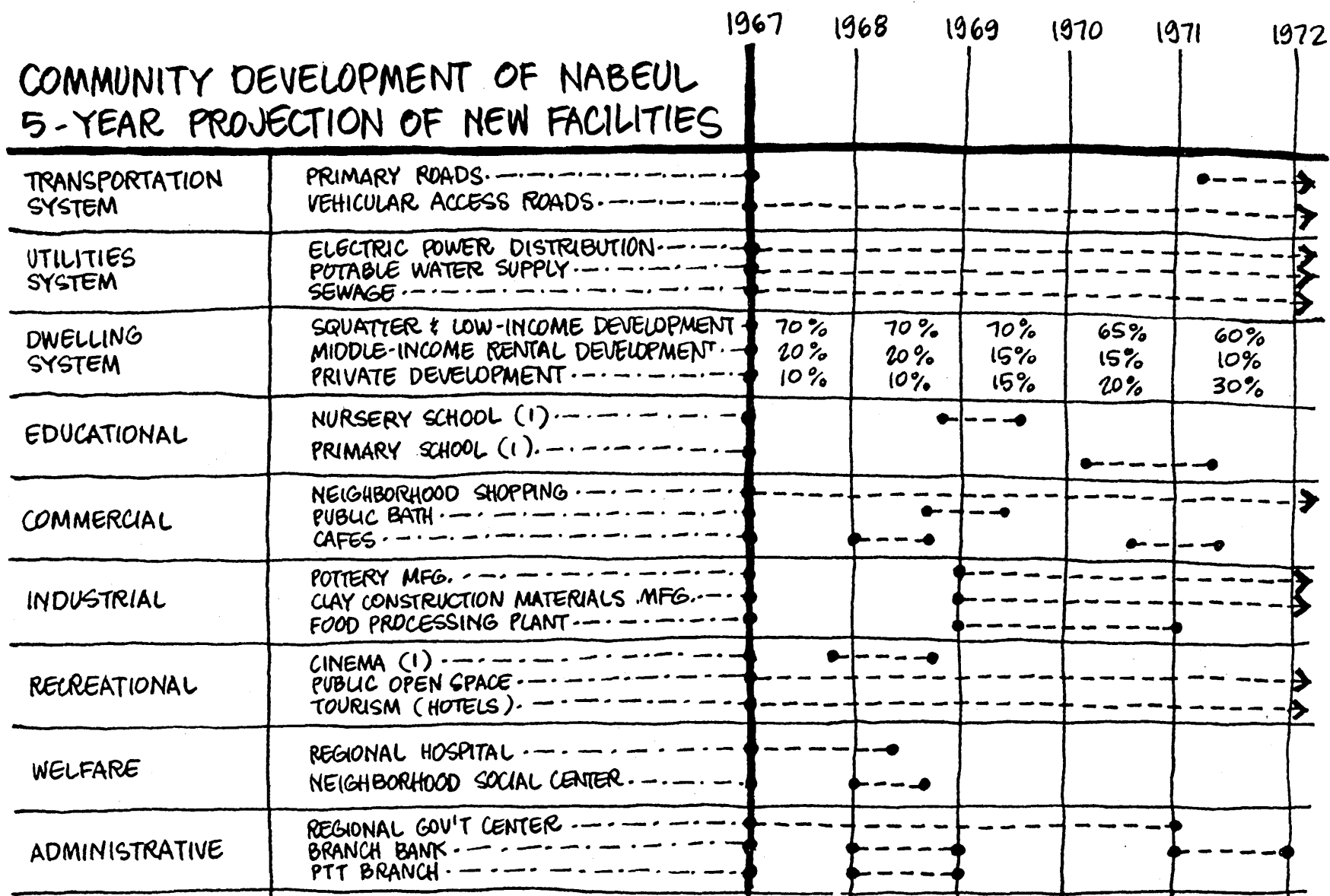
- 1) Promote maximum economic growth;
- 2) Encourage social and technological modernization;
- 3) Recognize and reinforce desirable values of Tunisian society;
- 4) Provide basic environmental amenities; but,

- 5) Minimize non-productive investments;
- 6) Utilize to the fullest extent local techniques and resources;
- 7) Anticipate change by providing flexibility.

One of course notices potential conflicts as with all sets of criteria. However, the intent and purpose is evident: plan to make the best use possible of all available resources, avoiding those things which are not absolute necessities and which do not contribute to satisfying fundamental needs and expectations of the population.

Illustration #20 tabulates the specific operational goals which the final proposed development plan will reflect. Related priorities and methods of implementation will also be postulated and shown.

Before making the final master plan, a kind of synthesis of all of the forces which would affect most significantly Nabeul's development was summarized graphically. This "plan of influences" (see Appendix) is in part a reflection of what I refer to as "environmental maps." To gain insight into the nature of physical environment, it is helpful to think of environment as it is perceived and used by those who occupy it.



A common failing of designers is to make plans as if everyone had the same view of his surroundings (usually the designer's view), and as if there was only one activity network in the city.

In reality, a community or a city is made up of what Melvin Webber calls "urban realms."⁴ Each individual has his own way of seeing and moving and participating in civic life. That way is dependent on many factors, among which some of the most obvious are his dwelling location, his socio-economic status, his age and his sex. If one were to draw a map showing the spatial environment for each individual, one would probably find that no two individual's maps were alike. Each inhabitant is aware of different physical landmarks, focuses on different activity centers and follows different paths. Consequently, in considering a community development proposal, the designer should be aware of the multiplicity of community networks and foci described by the users of the community.

For Nabeul, only six sample maps were drawn, based primarily on observations made while living in the town

⁴ Melvin M. Webber, "The Urban Place and the Non-place Urban Realm" in Explorations into Urban Structure, Melvin M. Webber, ed., Philadelphia, The University of Pennsylvania Press, 1964.

(see Appendix). These demonstrate the "use" of the town by various inhabitants. From these, and implicitly from many others, major circulation patterns and community foci were derived and plotted on the plan of influences. In addition, such influences as land values, accessibility, boundary conditions, existing or stabilized land use, and important growth tendencies were expressed. The plan shows how the city works and how it is physically constrained and motivated.

It should again be emphasized that Nabeul consists of many setsof foci, used differently by different people at different times, rather than one or two simple, major foci. The development plan (see Appendix) then emerges from this plan of influences, taking into account the existing context and seeking to meet the operational goals.

The proposed development plan reacts to the "influences" as follows:

- 1) The heretofore separate towns of Nabeul and Dar Chaabane are merged to unify the total community, to make use of accessible but inexpensive land, and to minimize infrastructure costs.
- 2) Land is allocated for residential development

at all socio-economic levels in proportion to demand, population composition, and land values.

- 3) Existing residential densities are maintained.
- 4) Land is allocated for commercial, institutional, industrial, and recreational activities to maximize the intensity of use, to preserve the character of the town, to minimize the cost of services, and to allow for maximum flexibility.
- 5) The government will limit its direct investments to access roads, utilities, schools, and related administrative facilities.
- 6) Provision is made to preserve rights of way for future roads and highways while maintaining open spaces.
- 7) A stronger link, both functionally and perceptually, will be made to the Mediterranean.
- 8) Considerable space immediately adjacent to the town will be reserved for long-range, unspecified development.
- 9) The areas to the north and northwest of Nabeul will remain as cultivated orchard lands.

The phasing and establishment of priorities for this plan take into account the time range for development

and the urgency or need for the facility in question. Three time ranges are given: short, medium and long. Short and medium range refer to the next five or six years. Long range indicates that the need will arise and be fulfilled at some date beyond the immediate scope of this plan.

Likewise, there are three levels of priority. High priority developments are those which are considered indispensable in meeting the overall development goals. Lower priority items can be assumed to be less fixed and more subject to manipulation and postponement. Obviously, time ranges and priorities are interrelated.

Finally, the proposed plan attempts to differentiate the means by which various community facilities are developed. Four essential methods of development are postulated. First, as suggested above, certain facilities will be initiated and developed exclusively by the government. These will be facilities which are for public use and fall under public responsibility. Second, other facilities will be exclusively developed by private interests, and this is particularly true of residential development in the middle-income areas. (This does not exclude government control of the planning and design involved in such developments, nor control over land).

The third method of implementation, and perhaps the most important, will embody private development combined with government initiative (but not government subsidy). For example, the key to providing extremely low-cost dwellings will lie in the government's ability to allocate cheap land, or land which it controls, provide basic services, and use persuasion to encourage individuals to build up their own housing. The fourth method entails private development with government underwriting. This applies most particularly to industrial and commercial projects where the government acts as a catalyst by providing both capital and surety. Much hotel construction has been undertaken this way.

A glance at the proposed plan (see Appendix) will not yield the viewer some singular, overwhelming concept or macro-structure. Like the environmental maps, this plan instead expresses the different sets of requirements and use systems superimposed on each other. Of course, many simplifying assumptions were made to arrive at this solution. It is still very much a sample exercise which would demand more rigorous treatment in the field. The point is that by choosing such a problem,

and by selecting its most salient issues, a design evolved which both treated the issue and tested the applicability of a variable checklist.

The conclusions to be drawn will come directly from the checklist description in its most literal terms. The checklist illustration once again shows no more than the variables considered and the chain of the design process (see checklist history #21).

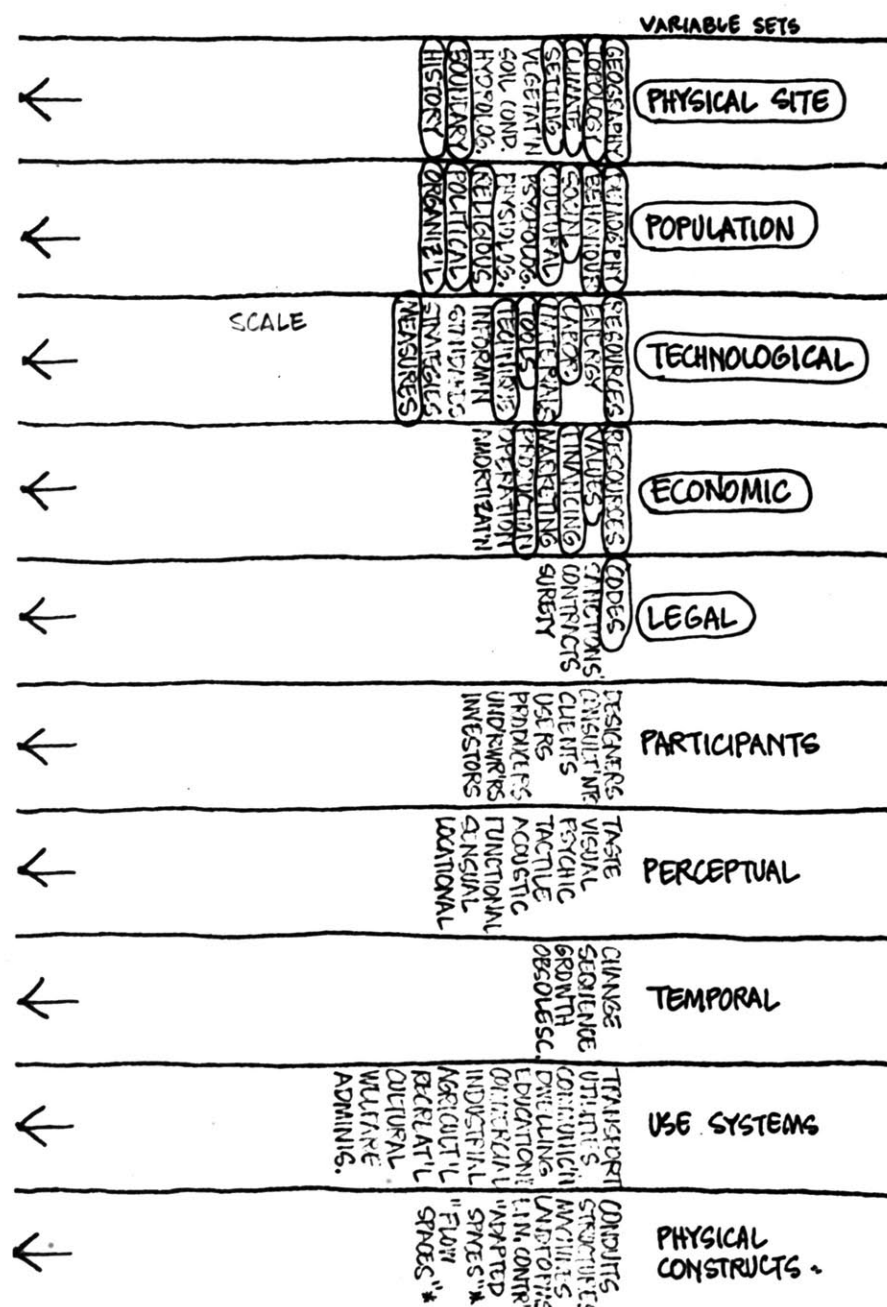
21. CHECKLIST DESCRIPTION OF STUDY OF NABEUL.

CONTEXT

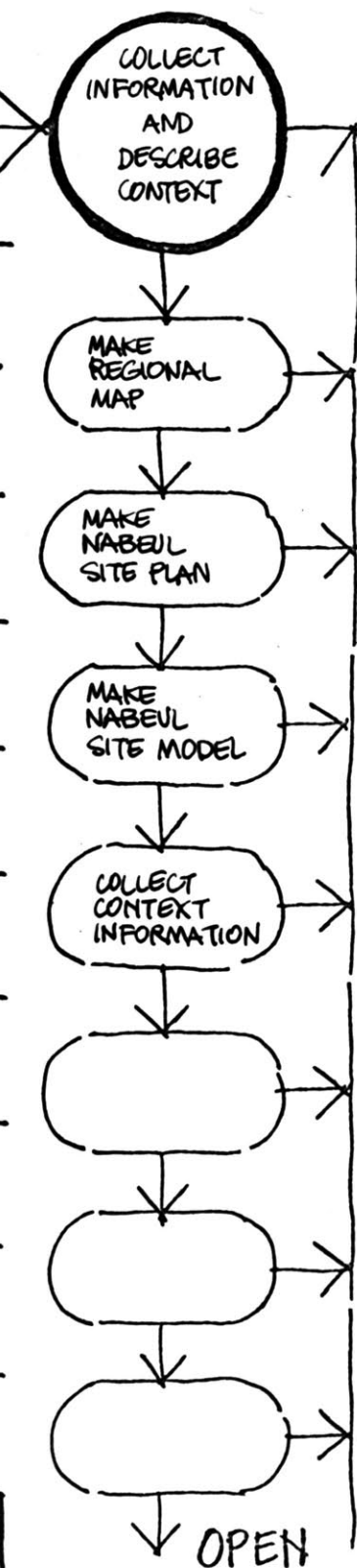
GOALS PERFORMANCE

GENERIC PROCESS SOLUTION

EVALUATION



SEQUENCE	DATE	NOTES AND REFERENCES
1	MAY 1967	

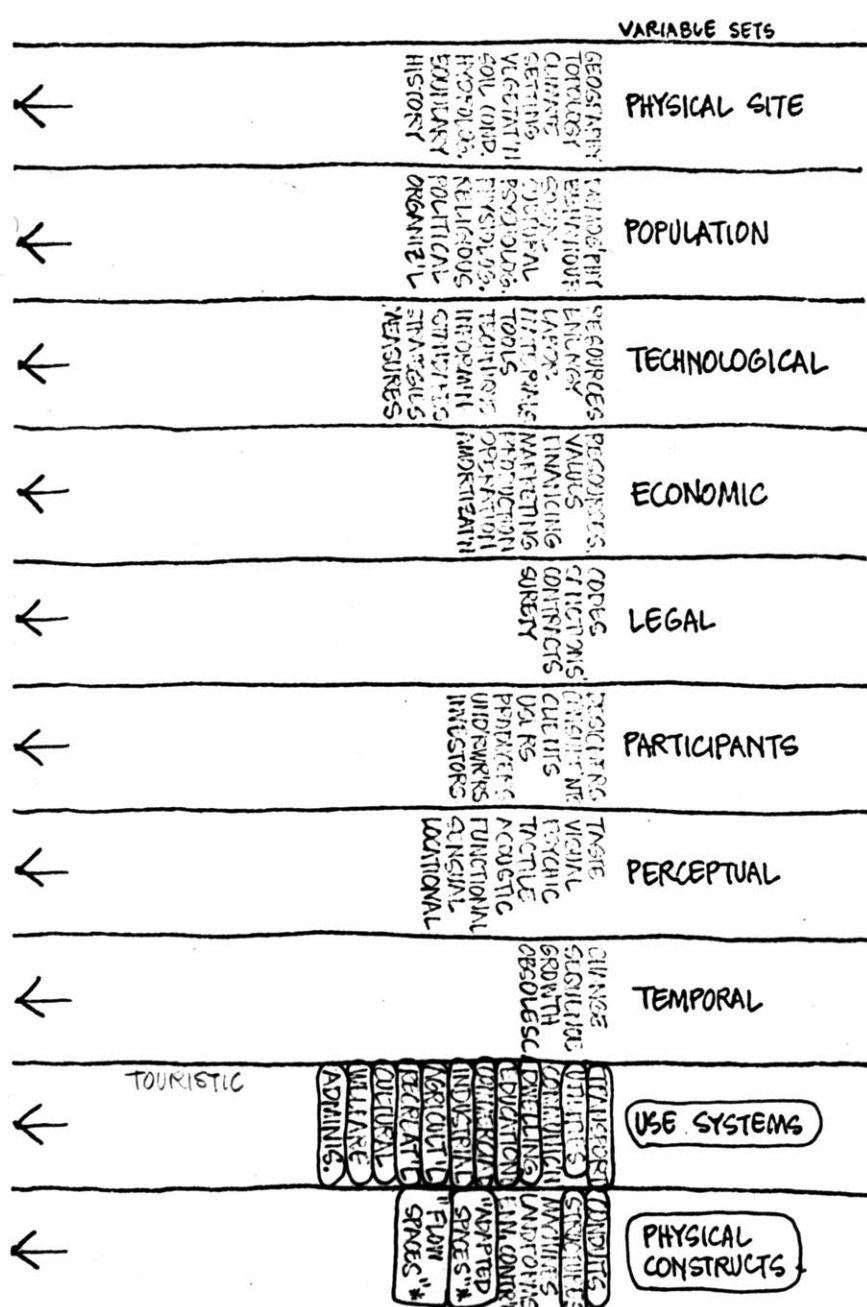


CONTEXT

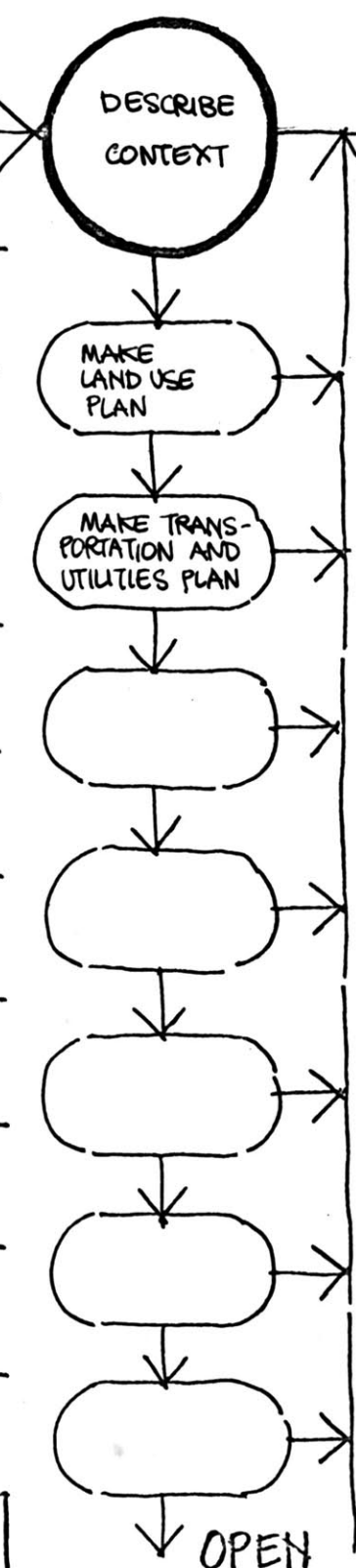
GOALS PERFORMANCE

GENERIC PROCESS SOLUTION

EVALUATION



SEQUENCE	DATE	NOTES AND REFERENCES
2	MAY 1967	

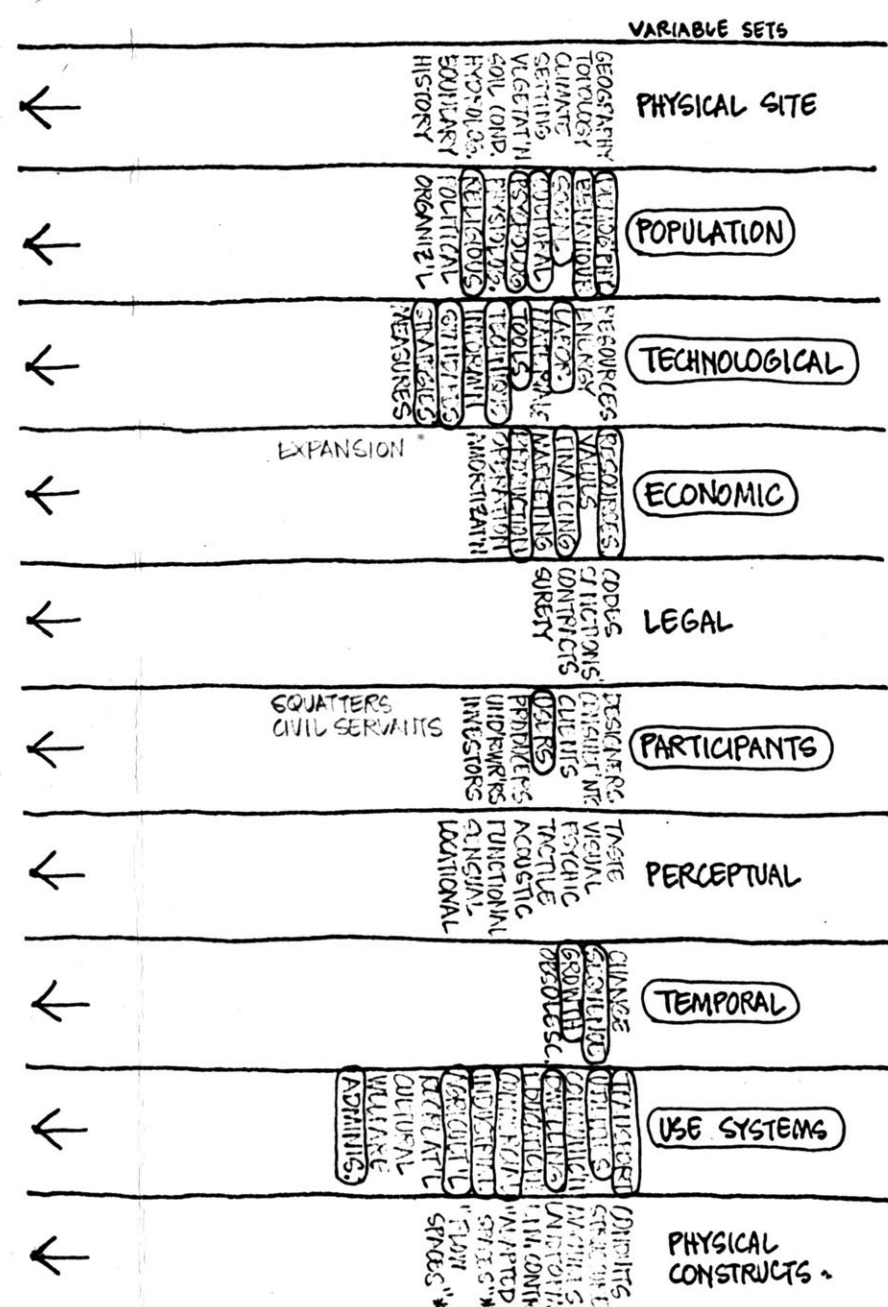


CONTEXT

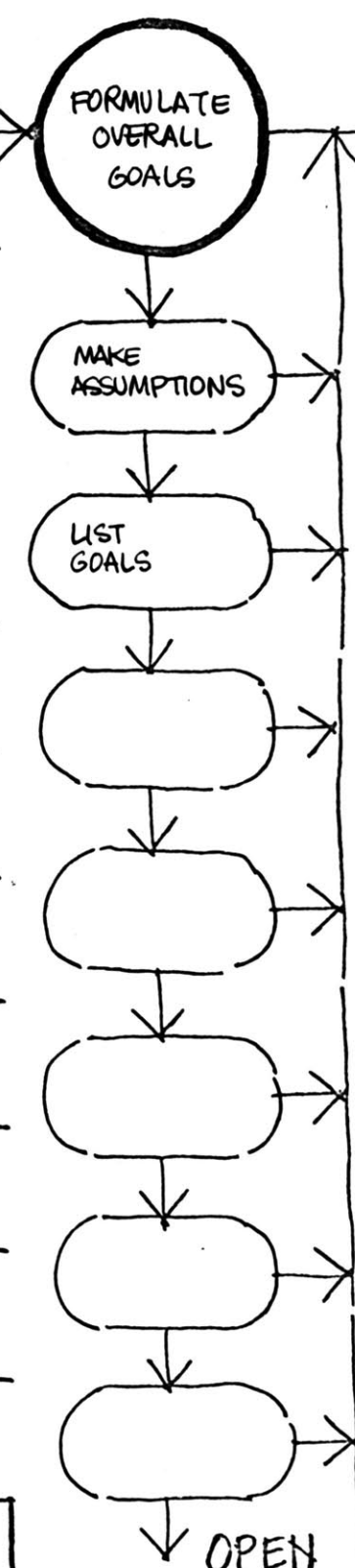
GOALS PERFORMANCE

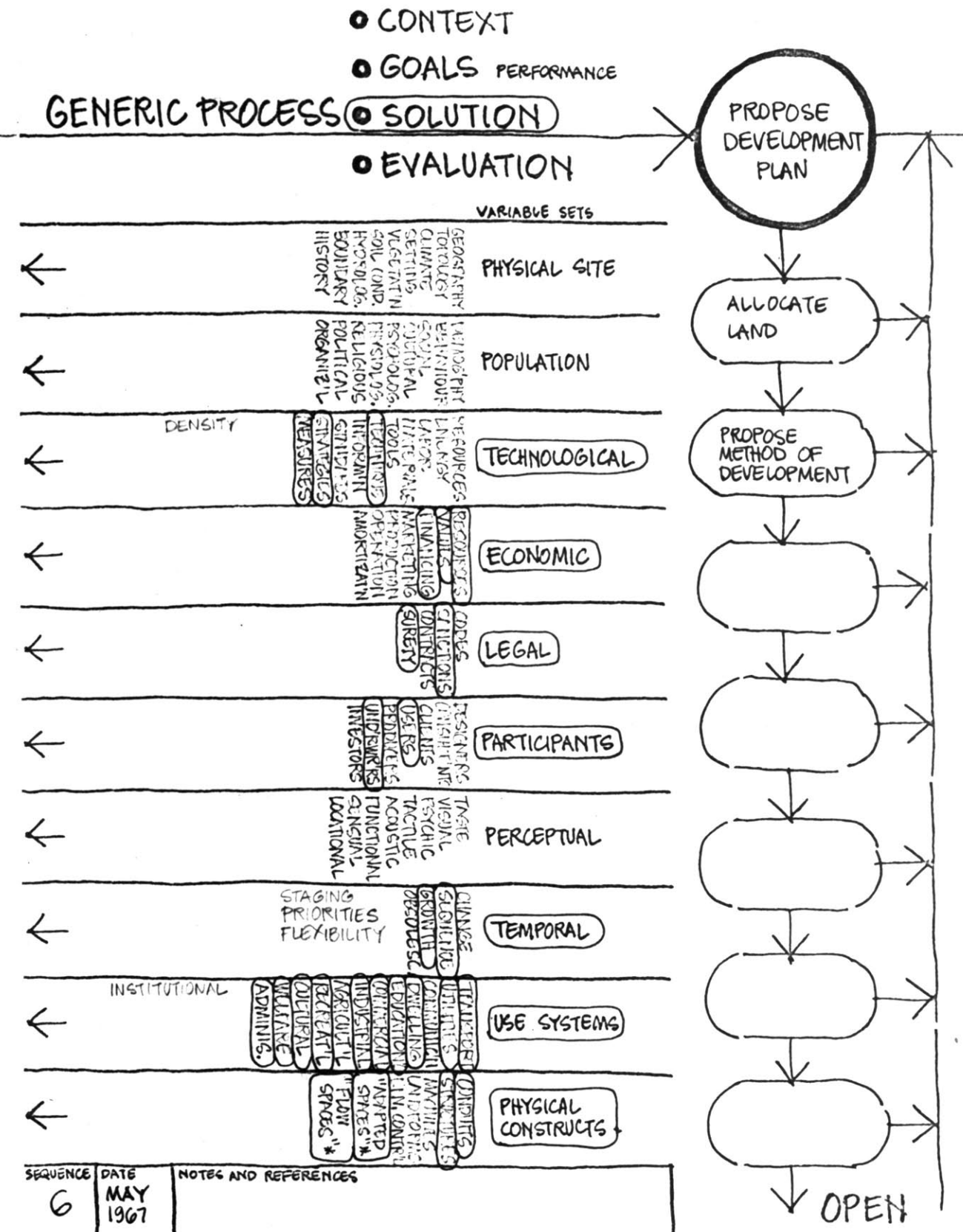
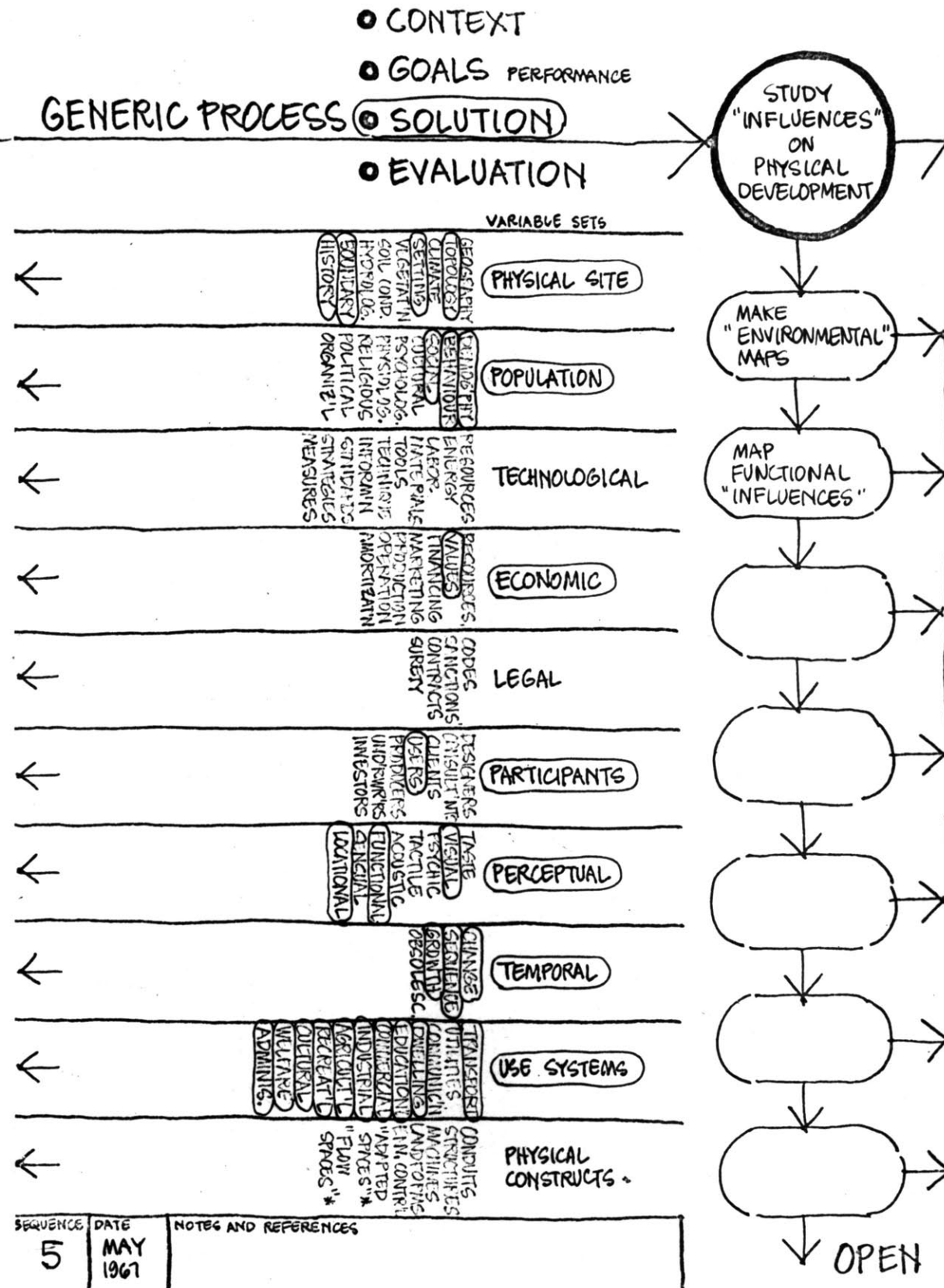
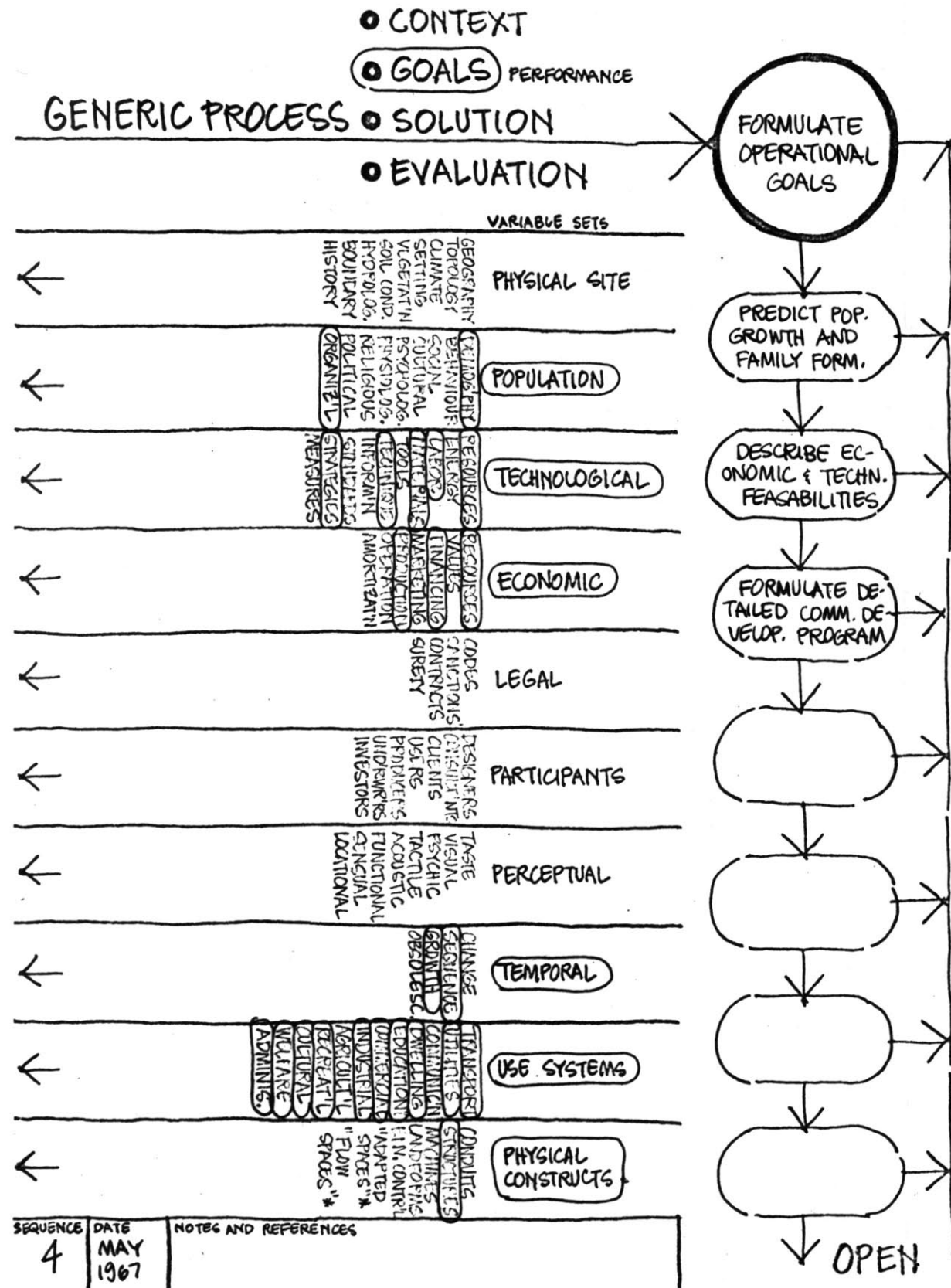
GENERIC PROCESS SOLUTION

EVALUATION



SEQUENCE	DATE	NOTES AND REFERENCES
3	MAY 1967	





CONCLUSIONS AND SUGGESTIONS

The community development study of Nabeul was fairly straight-forward. It proceeded from context description to goal definition to solution, or alternative proposal. The design variable checklist was consulted periodically both to plan phases of the design effort as well as to serve as a reminder to the designer about design issues. The list was referred to at the outset of a step in the design and again as that particular step was finished. The list was very useful in helping to describe and study the existing conditions and in formulating performance goals. It was less useful in the actual process of design synthesis.

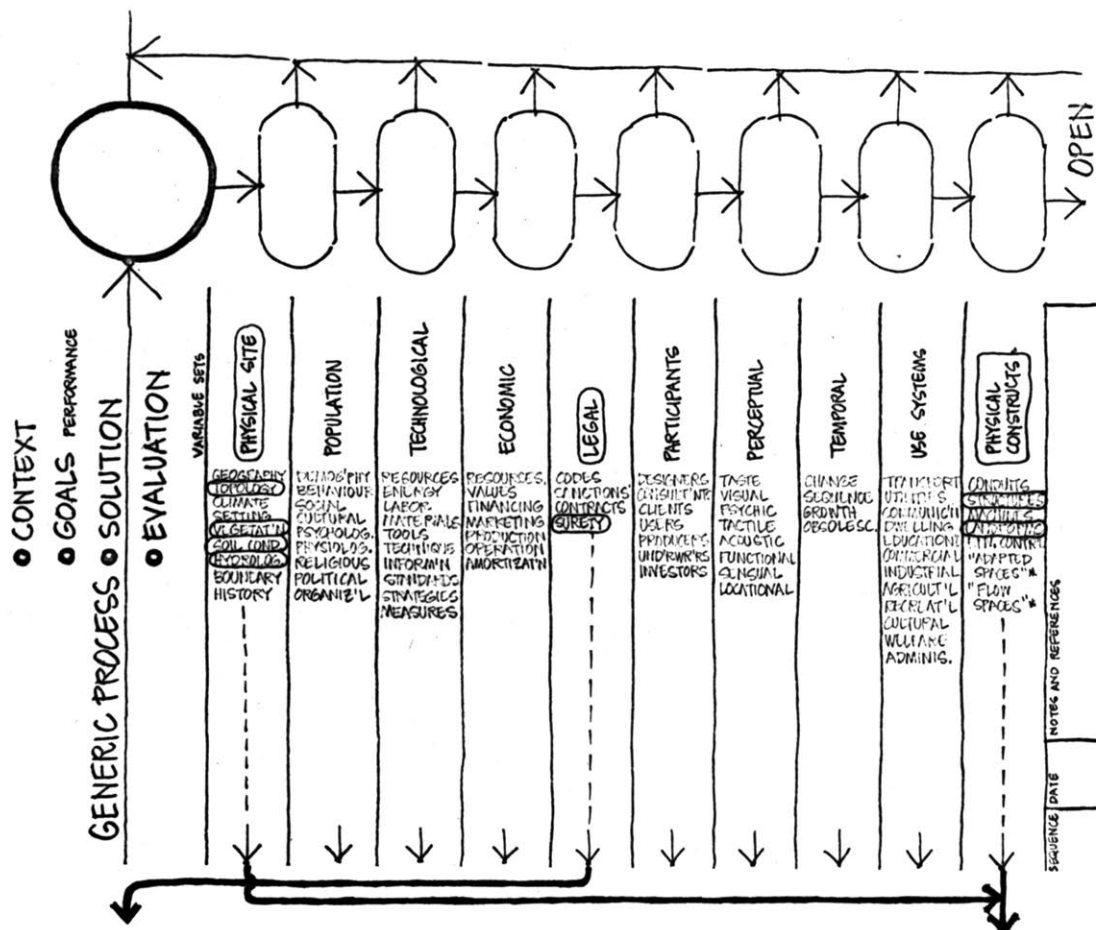
Briefly, the checklist approach is valuable in three ways: 1) as an organizational aid (speeding up considerably the study that was made); 2) as an aid in identifying and recalling important areas of interest; 3) as a tool for autocriticism. Scanning the list continually raises questions and goads the designer by the process of association.

From both the university campus history and the study of Nabeul, the design process appears as a melding of objective and subjective inputs, rather than a "procedure" analogous to the design of a steel column. Value

judgments, taste, and the powers of observation are critical and inevitable in any environmental design. Thus, the checklist expands the awareness of the designer without in any way specifying the attributes of the design or the absolutes of design process.

Again, this list of variables needs modification and expansion. It is still only a set of labels which slide around and lead the designer to raw data. Perhaps the list is most valuable at this stage for making inferences. It is more implicit than explicit when it is used rigorously. Each architect or planner really needs to make his own problem-oriented checklist as judgment dictates. Any such checklist will have to be applied to other problems to fully develop its generality.

Eventually, this checklist could be backed up with other, smaller-scale lists or sets of variables which would deal with specific areas of interest, such as "physical constructs" or detailed sociological considerations (see illustration #22). A designer would probably use this master list in the same way that he uses scattered reference books, his own experience, and intuition, at present. The implication of this is not that design output will change radically, but that the designer's



CHECKLIST ON PROTECTION

This checklist is based upon the foregoing discussion of the more common risks and insurance or bond coverages to be considered by architects, owners, contractors and their attorneys and insurance counselors.

Architect's Liability—

1. Professional Liability including Contractual ("hold harmless")
2. Comprehensive Personal Liability
3. Comprehensive General Liability—Occurrence Basis
 - a. Premises—Operations
 - b. Elevator
 - c. Contingent
 - d. Contractual
 - e. Completed Operations—Products
 - f. Broad Form Property Damage Endorsement
 - g. Property Damage XCU Endorsement (Explosion, Collapse, and Underground Damage)
 - h. Personal Injury Endorsement (Invasion of Privacy, False Arrest, Libel, Slander, Defamation of Character)
4. Excess or Umbrella Liability
5. Comprehensive Automobile Liability—Occurrence Basis
6. Aircraft or Watercraft Liability
7. Fire Legal Liability
8. Water Damage and/or Sprinkler Leakage Legal Liability
9. Nuclear Energy Liability

Architect's Personnel—

1. Workmen's Compensation & Employers Liability
2. Disability Income—Salary Continuance
3. Major Medical
4. Hospitalization—Surgical Expense
5. Life Insurance—Group-Key Man Partnership
6. Accident Insurance—Death, Permanent Disability
7. Retirement—Pension—Deferred Compensation

Architect's Office—

1. All Physical Loss—Building or Leasehold Improvements
2. Fire, Extended Coverage and Vandalism
3. Boiler and Machinery
4. Water Damage—Sprinkler Leakage
5. Collapse
6. Comprehensive Glass
7. Demolition Endorsement
8. Office Contents Special ("All Risk") Form
9. Valuable Documents
10. Equipment Floater
11. Automobile Material Damage & Collision
12. Business Interruption—Loss of Use
 - a. Business Interruption—Fire, Extended Coverage or All Physical Loss
 - b. Rental Value—Fire, Extended Coverage or All Physical Loss
 - c. Extra Expense—Fire, Extended Cov-

- d. Boiler & Machinery Use and Occupancy
- e. Water Damage—Sprinkler Leakage Use and Occupancy
- f. Leasehold Interest
13. Package Policy
14. Theft-Robbery-Burglary
15. Broad Form Money & Securities
16. Fidelity Bonds
17. Forgery Bonds
18. Credit Card Forgery
19. Blanket Crime Policy—Comprehensive Dishonesty, Disappearance, Destruction Bond

This checklist should be applied to each project in accordance with the prevailing circumstances and requirements. In all insurance matters the determination of specific coverages is the function of insurance counselors; it is not the responsibility of the architect.

This checklist is not represented as being all-embracing and the practitioner should consult his insurance counselor to determine his needs.

Contractor Requirements—

1. Workmen's Compensation & Employers Liability
2. Comprehensive General Liability—Occurrence Basis
 - a. Premises—Operations
 - b. Elevator—Hoists
 - c. Contingent
 - d. Contractual
 - e. Completed Operations—Products
 - f. Broad Form Property Damage Endorsement
 - g. Property Damage XCU Endorsement (Explosion, Collapse, Underpinning)
 - h. Personal Injury Endorsement
3. Comprehensive Automobile Liability—Occurrence Basis
4. Aircraft or Watercraft Liability
5. Nuclear Energy Liability
6. Excess or Umbrella Liability
7. Contractor's Equipment Floater
8. Workmen's Tools Floater
9. Transportation Floater
10. Installation Floater
11. Automobile Material Damage & Collision
12. Broad Form Money & Securities
13. Fidelity Bonds
14. Forgery Bonds
15. Theft-Robbery-Burglary
16. Blanket Crime Policy—Comprehensive Dishonesty, Disappearance, Destruction Bond
17. Surety Bonds—See Owner Requirements
18. Property Insurance—Fire, Extended Coverage and other perils.

Owner Requirements—

1. Workmen's Compensation & Employers Liability
2. Comprehensive General Liability—Occurrence Basis
 - a. Premises—Operations

- b. Elevator
- c. Contingent
- d. Contractual
- e. Completed Operations—Products
- f. Broad Form Property Damage Endorsement
- g. Property Damage XCU Endorsement
- h. Personal Injury Endorsement
3. Comprehensive Automobile Liability—Occurrence Basis
4. Aircraft or Watercraft Liability
5. Nuclear Energy Liability
6. Excess or Umbrella Liability
7. Property Insurance
 - a. All Physical Loss—Builder's Risk Completed Value Form or Reporting Form
 - b. Fire, Extended Coverage & Vandalism—Builder's Risk Completed Value Form or Reporting Form
 - c. Boiler and Machinery
 - d. Comprehensive Glass
 - e. Electric or Neon Sign Form
 - f. Bridge-Tunnel-Radio or TV Towers Special Forms
 - g. Water Damage—Sprinkler Leakage
 - h. Collapse
 - i. Nuclear Energy Property Insurance
 - j. Radioactive Contamination
 - k. Demolition
8. Business Interruption—Loss of Use
 - a. Business Interruption—Fire, Extended Coverage or All Physical Loss
 - b. Rental Value (Fire, Extended Coverage or All Physical Loss)
 - c. Extra Expense (Fire, Extended Coverage or All Physical Loss)
 - d. Boiler and Machinery Use & Occupancy
 - e. Water Damage—Sprinkler Leakage Use & Occupancy
9. Legal Liability for Property of Others in Insured's Custody
 - a. Warehousemen
 - b. Safe Depository
 - c. Fur Storage
 - d. Cleaners & Laundries
 - e. Garage Keepers
 - f. Other Bailees
10. Package Policy
11. Surety Bonds
 - a. Bid
 - b. Performance
 - c. Labor and Material Payment
 - d. License or Permit
 - e. Lien
 - f. No Lien Bond
 - g. Maintenance
 - h. Release of Retained Percentage
 - i. Statutory
 - j. Subcontract
12. Automobile Material Damage & Collision
13. Broad Form Money & Securities
14. Fidelity Bonds
15. Forgery Bonds
16. Theft-Robbery-Burglary
17. Blanket Crime Policy—Comprehensive Dishonesty, Disappearance, Destruction Bond

2 SITE WORK

0200. ALTERNATES
0201. - 0209. unassigned
0210. CLEARING OF SITE
0211. Demolition
0212. Structures Moving
0213. Clearing & Grubbing
0214. - 0219. unassigned
0220. EARTHWORK
0221. Site Grading
0222. Excavating & Backfilling
0223. Dewatering
0224. Subdrainage
0225. Soil Poisoning
0226. Soil Compaction Control
0227. Soil Stabilization
0228. - 0229. unassigned
0230. PILING
0231. - 0234. unassigned
0235. CAISSONS
0236. - 0239. unassigned
0240. SHORING & BRACING
0241. Sheet piling
0242. Underpinning
0243. - 0249. unassigned
0250. SITE DRAINAGE
0251. - 0254. unassigned
0255. SITE UTILITIES
0256. - 0259. unassigned
0260. ROADS & WALKS
0261. Paving
0262. Curbs & Gutters
0263. Walks
0264. Road & Parking Appurtenances
0265. - 0269. unassigned
0270. SITE IMPROVEMENTS
0271. Fences
0272. Playing Fields
0273. Fountains
0274. Irrigation System
0275. Yard Improvements
0276. - 0279. unassigned
0280. LAWNS & PLANTING
0281. Soil Preparation
0282. Lawns
0283. Ground Covers & Other Plants
0284. Trees & Shrubs
0285. - 0289. unassigned
0290. RAILROAD WORK
0291. - 0294. unassigned
0295. MARINE WORK
0296. Boat Facilities
0297. Protective Marine Structures
0298. Dredging
0299. unassigned

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22.

NOTE VARIABLE INTERACTIONS, OVERLAPPING.

method will become more systematic and more thorough.

He will, in fact, be in a far better position to exercise his imagination.

In retrospect, the generation of a community-scale design variable checklist and its subsequent application has proved to be an extremely educational exercise. The gap that exists between building scale and city scale now seems less formidable. Perhaps this study will aid students, teachers and researchers in gaining insight into the complexity of the designer's task. In time, it might even make that task less tedious, more creative, and more skillfully performed.

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APPENDIX

